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Tennessee Gas Transmission Co.
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Texas-Illinois Natural Gas Co.
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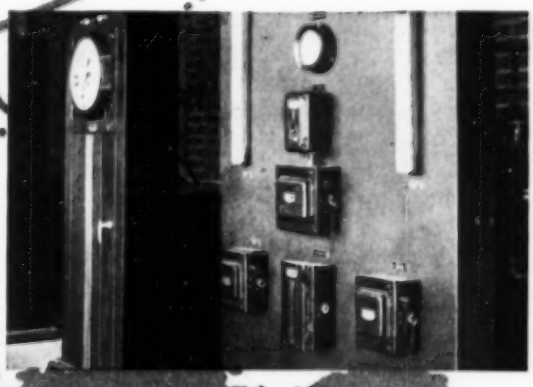

C-H Calorimeters *(at left)* measure accurately and uncompromisingly the B.t.u. content of each unit volume of gas distributed regardless of temperature, pressure or flow variables, and write a continuous available record.

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C-H Jet type mixers *(at right)* automatically mix gases of variable heating value to a final low pressure stabilized value. When mixing directly into gas mains as well as into holders, they automatically adjust production to widely varying demands.

GAS

30th Year of Publication

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Thermally Thinking

SPOT NEWS AND COMMENT ON GAS INDUSTRY AFFAIRS

Highlighting the News

American Louisiana first victim of new FPC rule

Under its famed rule 174 freezing wellhead prices of independents and bringing them into its jurisdictional sphere, FPC early last month halted action on approving the American Louisiana Pipe Line Co.'s proposed $130 million system for want of certificates from suppliers. American appealed and the commission denied the appeal, and American appealed again. (See "An Eye on the Capital.")

Independents up in arms over 174-A

A total of 13 companies had petitioned the commission for rehearing as of August 19. Among the biggest were Ohio Oil, Magnolia, Humble, Gulf, and Tide Water. Kerr-McGee Oil Industries, Inc., in its petition, asserted that the order incorrectly interprets both the letter and intent of the Natural Gas Act and contravenes the Constitution by requiring applications for certificates without proceedings to determine if applicants are able and willing to accept such and perform thereunder as required by the Natural Gas Act. Also, in the Union Producing Co. petition it is stated that under Sec. 4(c) of the Natural Gas Act, the commission has no power to suspend an original filing, but that Order 174-A "purports to require original filings by independent producers in accordance with Sec. 4(c) and then assumes to suspend the same in contravention of Sec. 4(c)."

Two producers certificated

Meanwhile temporary sales permits have been issued to two Class B independent producers for sales to United Gas and Natural Gas Pipeline Co. of America. However, John Merriam, president of Northern Natural Gas, and other gas pipeline company executives have been quoted as noting a withdrawal of offerings by several producers who fear FPC regulation.

Water heater, range sales continue their separate ways

A 9% gain in shipments of water heaters in July (over July 1953) brought the year to date shipments to .9% ahead of last year, GAMA reports. The month's record of 189,500 gave a year-to-date total of 1,319,800, 11,300 ahead of 1953. But the month's range shipments were once again off from the comparable 1953 month. A total of 129,000 units was 30,000 under 1953's figure, giving a year-to-date total of 1,104,400, 14.4% under 1953.

Rate boosts easing in New York

For the fiscal year recently ended, New York state's PSC approved $10,647,000 in rate increases, the smallest sum since 1946. And rate reductions aggregating $1,103,000 gave a net increase of $9,544,000. Postwar peak was 1948, when $43 million was certified. In 1952, more than $40 million in raises was granted.

First entire system is taped

The town of Waynesboro, Ga., is completing the first tape coating of an entire system in its new natural gas distribution net. More than 30 miles of 1½- to 6-in. pipe was treated. Newly developed power taping equipment was used on the 3- to 6-in. mains.

Ex-PG&E employees sue over loyalty firing

Discharged four days after they had refused to testify at a hearing of a California senate committee on un-American activities, four former Pacific Gas & Electric employees are suing the committee for $218,333 damages. The firings occurred a year ago.

An Eye on the Capital

Producers must register by Oct. 1

Oct. 1 is the deadline the Federal Power Commission has set for registration of producers of natural gas, who now are subject to the FPC's jurisdiction by virtue of the Supreme Court ruling in the famous Phillips case.

Oct. 1 also is the date on which, according to American Louisiana Pipe Line Co., it must get approval from FPC for a pipeline that it wants to build from southern Louisiana into Michigan, serving communities along the way.

The FPC said that it must know who the suppiers are, how much gas they can supply and other details, before it can grant a certificate to American Louisiana, which is a subsidiary of the American Natural Gas System.

As a result, American Louisiana's application is stymied, but no more so than the FPC, which, in late August, was wondering how long the gas producers and gatherers were going to wait to file. Precious few, if any producers, had come forward before Sept. 1.

It was rumored at FPC that some of the producers wanted to do business only intrastate, i.e., in Louisiana, Texas, or Oklahoma, or Kansas, and that they would not file with the FPC. The commissioners take the view that that is all right with them, if the company actually wants to do business only inside a state boundary, but they believe that very few companies, relatively, will cut off lucrative business which they have built up beyond state borders.

If the producers wait until Sept. 30 to put in their applications for certifi-

Thermally Thinking

cates, as seems likely in many cases, and if American Louisiana really *must* know something from the FPC before Oct. 1, it looks as if the proposed pipeline is really in deep trouble. But FPC commissioners imply they have learned to take deadlines with a grain of salt, and they indicate that they believe they can act on American Louisiana's application fairly promptly after the date on its producer-suppliers is in hand. They also believe that American Louisiana can work out some other deals, if projected contractors welsh because FPC has caused the company to fail to meet its deadline in getting a certificate.

Incidentally, Panhandle Eastern Pipe Line Co., which has its own troubles with the FPC, actually intervened here to try to stop consideration of the proposed $154 million pipeline projected by American Louisiana. The commissioner did not delay because of Panhandle Eastern, but because of the physical facts in the case and to abide by its own rules, laid down earlier. American Louisiana would extend from Louisiana to southern Michigan, if the FPC were to grant it a certificate.

FPC amends original order

The FPC, incidentally, has amended its three-week-old order for regulating gas producers and gatherers, with the avowed purpose of simplifying compliance procedures, after strong public questioning by the Independent Petroleum Association of America, challenging the legality of Rule No. 174.

The order remains basically the same, but relaxation of certain of the provisions will make it simpler for small operators to file the necessary documents. Under the new order, in the case of an established or new service calling for interstate sales by gas producers of less than 1000 MMcf of natural gas in interstate commerce annually, the applicant will have to file only an original and five copies of an abbreviated form.

Producers whose aggregate sales are more than 1000 MMcf annually must file a certificate application in only slightly greater detail, and are required to furnish 14 copies of the original. All of this must be done by Oct. 1, if the interstate operations were carried on at the time of the Supreme Court decision in the Phillips Petroleum case on June 7. The Supreme Court, incidentally, has denied a writ of review at this time of the Phillips case. Magnolia Petroleum Co., Ohio Oil Co., and Humble Oil & Refining Co. still are challenging the legality of the FPC action.

Prompt refusal for rehearing in Northwest

The Federal Power Commission has acted rather promptly in denying all requests for a rehearing of its decision authorizing the Pacific Northwest Pipeline Corp. to take natural gas to the Pacific Northwest from the San Juan basin of New Mexico and Colorado.

Westcoast Transmission Co. and other competing applicants, which had sought to supply the Northwest with Canadian gas, have announced their intention of carrying the case to the 3rd U. S. Circuit Court of Appeals in Philadelphia, but it is certain that it will be some months before that court will render a decision. The judges will have a voluminous—some call it a monumental—mass of paper work through which to wade before they can hand down a decision in this appeal, for the original case was before the FPC for two years, during which time something of a record was set for verbosity.

Pacific Northwest, incidentally, has announced here that it has signed contracts to serve natural gas to virtually every Washington state community along its pipeline route. Allen Pevser, president of Washington Gas & Electric, said the advent of natural gas in that area is particularly important in view of the national program of dispersing industry into communities of the size of those served by his company.

Unions close to merger

Merger of the Oil Workers International Union and the Gas, Coke, and Chemical Workers (both members of the Congress of Industrial Organizations) has moved another step forward here, at meetings between officials of the two large unions.

A 12-man committee, representing both unions, is working to agree on an acceptable constitution, and, once this hurdle is out of the way, the amalgamation likely will be ratified by conventions of the two unions.

If it comes to pass—and it seems most likely now—this development would make the combined oil, gas and chemical workers union the seventh strongest union organization, on the basis of number of members, inside the CIO. It would rank only behind the steel, auto, clothing, and textile unions, Communications Workers of America, and the rubber workers.

FPC faced with inadequate staff

Federal Power Commission officials, ranging from the chairman, Jerome K. Kuykendall, on down, have returned from their vacations wondering how they can make effective their jurisdiction over natural gas producers and gatherers without the personnel they say is essential for such an undertaking.

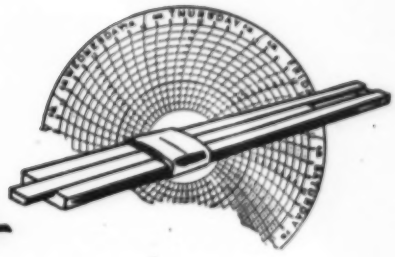
At FPC urging, President Dwight D. Eisenhower had requested $300,000 for the FPC so as to carry out the Supreme Court's mandate in the Phillips Petroleum case. However, the Senate Committee on Appropriations, by a 15-to-1 vote, agreed in effect with Sen. Lyndon B. Johnson (D.-Texas) that such funds should not be appropriated until the Supreme Court has heard the arguments for a rehearing and has ruled on that. The Senate later upheld the action of its committee.

Observers here interpreted this to mean that the FPC must wait until next spring for its regular appropriations before it can hire additional employees necessary to make its jurisdiction effective. In the interim, it is possible that the new Congress will have had a chance to consider legislation designed to nullify the effects of the Phillips decision, along the lines of the old Kerr Bill, vetoed in 1950. Congress was chafing at the bit to act on the legislation this year, but the Republican leadership, already faced with the prospect of fighting charges of "giveaway" from a thousand public platforms, hesitated to give word that such legislation would not be bottled up, if introduced.

It is thought here that FPC action on certain natural gas cases now pending

Continued on page 72

Technical Trends



• By GUY CORFIELD

8500 degrees Fahrenheit

The hottest spot ever produced and controlled by man is that at the focal point of a giant 120-in. diameter polished aluminum sun-reflecting mirror operated by the Consolidated Vultee Aircraft Corp. at San Diego, Calif. This solar furnace gathers the rays of the sun and focuses them at a 5/16-in. diameter point 34 in. from its center. The entire assembly is on a framework that can be rotated to keep pace with the sun's movement. An opening 22 in. in diameter in the center of the mirror enables observation of the focal point from a position on the ground behind it, through a 20-magnification telescope.

The temperature of 8500° F obtained by this furnace exceeds the oxy-acetylene torch (5800° F) and the carbon arc (6300° F). It is used to study the behavior of materials at high temperatures, without the interference of combustion products or other uncontrollable contaminants. The test specimen can be surrounded by any desired gaseous atmosphere by enclosing it in quartz glass, the glass not getting hot enough to melt as it is outside the focal point. Auxiliary mechanisms are provided to support the test specimen and move it into and out of the focal point, and to partially shade the mirror to obtain controlled temperatures. Convair is using this furnace for testing metals, ceramics, refractories and other heat resistant materials.

Plastic internal liners for steel pipe

An interesting operation has been developed in the oil industry whereby steel pipe is internally lined with a thin tube of semi-rigid Tenite butyrate plastic. Continuous plastic tubing has been inserted into 500-ft lengths of pipe, with flanged joints at the ends of the sections, but it is thought that 2000- to 3000-ft sections can be similarly handled. The plastic tubing, with wall thickness of 0.050 in. and outside diameter 0.125 in. less than the internal diameter of the steel pipe, is made up with solvent welded internal sleeve joints to a slightly longer length than the length of the steel section; it is then fastened to a scraper and pulled through behind the scraper. After the tubing recovers from stretch caused by the pulling, it is cut off flush with the steel flange faces and adapters are cemented to it which fit against the outside of the flange faces. These adapters, with a plastic spacer, are compressed between the flange faces of two steel pipe sections, thus producing a continuous all-plastic liner. Air in the annular space between the plastic tubing and the steel pipe is then expelled, through small holes previously drilled in the steel pipe, by internally pressuring the plastic tubing and, finally, the air vents in the steel pipe are closed with plugs.

Operating pressures as high as 980 psi have been successfully used with 2-in. pipe. It is claimed that such linings not only eliminate corrosion, but also give better flow capacity than the original steel pipe because of the smooth internal surface—apart from preventing the build-up of paraffin deposits that normally form on the inside surfaces of steel lines.

Steel showing increasing interest in plastics

The steel industry has for some time been aware of the potentialities of various types of plastic as materials for making tubing, pipe and fittings that may in many services replace or be an alternative for steel or other metals. Several companies have directly entered the plastic field, one of the latest being U. S. Steel's National Tube Division. Following pilot plant investigations commenced in 1951, National is setting up for commercial production of tubing at Gary, Ind. It is stated that operations will commence with extrusion of polyethylene and polyvinyl chloride, followed later by use of thermoplastics and reinforced thermosetting materials.

Another phase that is now receiving attention is steel pipe or tubing externally coated with plastic. It would seem that the strength of steel, combined with the corrosion resistance of many of the plastics, would be a very desirable combination. Republic Steel Co. is now in production of standard pipe sizes with an external extruded coating of Tenite butyrate.

National registry of rare chemicals

The Armour Research Foundation of the Illinois Institute of Technology, through its National Registry of Rare Chemicals, located in the Chemistry Research Bldg. at 3319 S. Dearborn St., Chicago, furnishes a free and unique public service to science and industry.

This service consists of providing information on the whereabouts and availability of hard-to-find rare chemicals, and is based on a card file of some 25,000 compounds. General information is also furnished on materials that can be used to meet unusual problems.

The registry, of which Dr. Gilbert Gavlin is director and Mrs. Rosaleen Burke is secretary, receives about 8500 letters per year, 10 to 15 telephone inquiries per day, and numerous telegrams and cablegrams. Most of the replies can be found in the card index, but some are obtained from the foundation scientists and sometimes a source of a rare material is sought through notices published in scientific journals. The registry is anxious to provide this service to anyone needing it, and would no doubt also appreciate notification of available source of rare or unusual chemicals.

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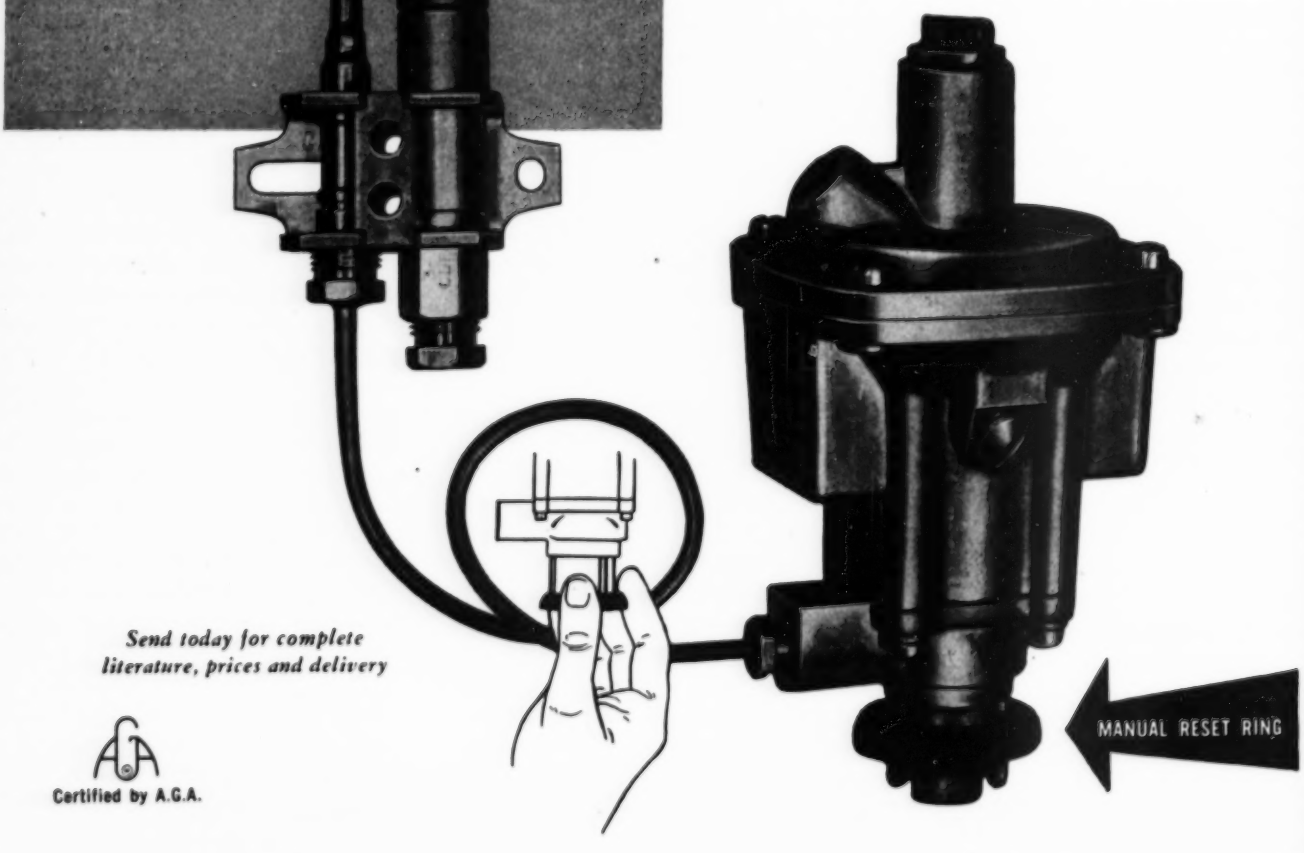

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Washington awaits natural gas

The men who began "looking to 1955" as possibly the fifth year of natural gas service in the Northwest, now look to late 1955 as the target date for the first deliveries. They are from left: Robert Herring, Pacific Northwest Pipeline; N. Henry Gellert, Seattle Gas; Stewart Matthews, Cascade Natural; Allen Peyser, Washington Gas & Electric; and William F. Devin, counsel for Pacific Northwest.

1. The preliminaries

BACK in 1947, the manufactured gas distributors of the Pacific Northwest, weary of treading water in the face of aggressive competition from low-cost hydroelectricity and fuel oil, were examining every possibility for a way out of their difficulties.

Here and there individual distributing companies were in serious financial difficulties. A few, with skillful management and conservative policies, managed to give the appearance of strength despite dwindling revenues and customer totals. And some went successfully into the sale of by-products.

Natural gas seemed to offer the best permanent solution to the problems of the manufactured gas distributors. So, to help determine their course, the troubled distributors chipped in for a regional survey to determine the potentialities for the sale of natural gas in the Pacific Northwest.

The survey showed an exceedingly strong need in the region for a source of thermal energy which natural gas could best provide—if it could be brought to the market at competitive prices.

Certainly it would take a little time to arrange it, but the market was there, natural gas could be brought to it. Little did the utility men know then what a long and tortuous battle it would be. The survey reported, with proper conservatism:

"Looking to 1955 as possibly the fifth year of experience in supplying natural gas to the Pacific Northwest . . ."

The Pacific Northwest is still "looking to 1955," and late 1955 at that. That's when the Pacific Northwest Pipeline Corp. plans to bring the first glimmer of the natural blue flame to the region.

Pacific Northwest Pipeline in June was authorized by the Federal Power Commission to bring gas to the Northwest from the San Juan basin of New Mexico, and from sedimentary basins further north. This authorization came after nearly two years of hearings (longest hearing in FPC history), 28,000 pages of transcript, and 650 exhibits.

Pacific's principal adversary in the complicated case, Westcoast Transmission Co., which proposed to bring gas from the Peace river region of northern British Columbia and Alberta, promptly applied for a rehearing. It was joined by Trans-Northwest Gas Co., which would have purchased gas from Westcoast for transmission to inland areas, and was supported by several intervenors.

The request for a rehearing was denied, however. The FPC said no new facts or allegations or principles of law were presented that were not considered previously. One legal avenue remained, an appeal to the courts, but the status of such an appeal had not been determined at this writing. According to Pacific's legal advice, the courts can only order a rehearing, and then only if evidence is presented that would indicate the Westcoast case had not been sufficiently heard.

2. The transmission company

PACIFIC, meanwhile, has proceeded without delay. Besides the FPC certificate of convenience and necessity, the company now has contracts with most distributors in the Northwest and is in the process of financing its 1466-mile, $160 million line.

Pacific expects to sell 364.6 MMcf of gas per day in its third year of operation. That figure represents the capacity of the line as it is now designed. Looping would be begun at this point to take care of additional demand.

The main dependence is being put upon the distributing companies by Pacific. Sales for resale will be 79.1% of the pipeline's third year load since direct sales to industrial customers will total 14.2 MMcf a year.

The company has, according to figures on record with the FPC, 3.646 trillion cu ft of proven reserves, but several substantial discoveries have been made since the official figure was filed.

Of that total official figure, 3.045 trillion cu ft is on Pacific's acreage in the San Juan basin, with .601 to come from the Tip Top and Big Piney fields of Wyoming and Piceance creek of Colorado, which are located in basins at least as large as the San Juan. Pacific expects full development of the producing areas, already stepped up by the favorable FPC decision, will give it a supply of gas far in excess of its needs to serve the area for 20 years or more.

The line as planned will be 26 in. in diameter in the south and will taper to 6 in. at Bellingham in northwestern Washington. Eight compressor stations will be a part of the initial construction with six more to be added by the third year to give the line 81,120 hp of compression. It will take parts of two construction seasons to complete the job.

A processing and dehydration plant will be built near Ignacio, Colo., to recover 30% of the propane, 85% of the butane and substantially all of the hexanes and heavier liquid hydrocarbons in the gas.

The first sale will be to Colorado Interstate Gas Co.—100 MMcf per day of 1100-Btu gas to be distributed in Denver and other Colorado cities. Colorado Interstate was authorized by the FPC to build a line to pick up and transmit this volume, at the same time that Pacific's line was certificated.

Pacific will serve a population of about 3 million in Washington, Oregon, Idaho, eastern Utah, southwest Wyoming, and Colorado. The company plans to use six mainline construction spreads to hurry the installation of the line. Target date for delivery is late 1955—five years later than the distributors first hoped in 1947.

Pacific Northwest Pipeline will have a high rating for know-how power, for its officers and directors are rich with experience in the United States gas and oil industry.

Ray C. Fish, chairman of the board, who was the original and still energetic creative force behind the Pacific project, engineered the first long distance natural gas pipeline of any consequence in this country, the Tennessee Gas Transmission Co. line, as well as the 2400-mile Transcontinental line from Texas to New York, and the Texas-Illinois line to Chicago.

President C. R. Williams has more than 20 years in the field. He was formerly in charge of operating properties for Chicago Corp. and also was general manager of the oil and gas division for the Continental Oil Co.

Robert R. Herring, youthful vice president in charge of marketing, had directed the design, construction and operation of many transmission and distribution systems.

Alfred C. Glassell Jr., vice president and director, and N. V. Kinsey, director, are independent oil and gas operators; Clyde H. Alexander, director, has 50 years experience in the oil and gas field; Leon M. Payne, secretary, was the firm's most active counsel in the FPC hearings, and C. K. Schwartz, director, was counsel for Petroleum Coordinator for War, 1941 to 1944.

3. The market

THE Pacific Northwest is a growing region with an optimistic industrial outlook. It is the only major section of the United States that does not now have a supply of natural gas, and this prospective new source of fuel is looked upon as being tremendously important industrially. It may be especially important in combination with the region's low-cost hydroelectricity. As complementing sources of energy, the two kinds of power will give vital aid to technology in the development of industries based upon wood derivatives, food processing and minerals.

In the Northwest's early development, timber was by far its most important resource. Wood wastes and locally mined, low-quality coal were the principal sources of fuel. But in recent years the diminishing availability of logged fuel and sawdust, due in part to better utilization by the lumber industry, and the falling off of coal production, caused a shift to oil.

This change to oil came even though costs were relatively high to all but users of huge amounts of industrial oil. Oil carried the transportation cost of shipment from California by tanker, and lately by pipeline from Alberta. Reshipment from coast points to inland areas increased the cost still more to a burdensome differential which works to the industrial disadvantage of such inland cities as Spokane. Although oil prices have varied from time to time and from place to place, the price has been about 39 cents per million Btu on the coast and from 48 to 65 cents per million Btu inland. Gas companies used this same oil to make gas and could compete only on a qualitative basis.

If natural gas could but approach the national average of natural gas consumption, 23.4% of energy used, it would have a tremendous success in the area for the Northwest's per capita consumption of gas is but one-twentieth of the national average. And only one-third of this small total is used by commercial and industrial concerns compared to 62% nationally.

New industries to be developed from resources plentiful in the Northwest, and in combinations unique to the region, cannot be completely foreseen at this time. However, much of the new industrial development will come as refinements of industries already established such as plywood, paper, pulp, hardboard, food processing, cement, brick and lime, insulation, primary metal users and fabricators, and chemical plants. The new and burgeoning aluminum industry can go from the production of ingots, which it now accomplishes with hydro power, to extrusion of the metal into finished products. The ceramics industry can progress from crude building materials to such things as fine china. There is an almost unlimited horizon with wood derivatives and a large potential in the food industry.

Reclamation in the huge Columbia river basin offers one of the region's bases for economic development. A continuation of the wood products industry is assured by extensive forest conservation, and the port cities have a huge potential as trade gateways to the far Pacific. Natural gas will serve to enhance all these potentialities.

Natural gas will displace oil for many established industrial uses, especially in such processes that require quick, clean heat, which can be accurately controlled and which, at the same time, is advantageous cost-wise.

In cases where either oil or gas can be used, cost, including the cost of conversion amortized over a period of time, will be the determining factor. This is the situation for all of those industries, previously mentioned, that are already established in the region. Distributors hope to capture much of this market with service on an interruptible basis. Interruptible sales, plus prudent use of existing manufactured gas equipment, will be used to obtain the highest possible load factor, which, in turn, will

help make gas competitive with oil. However, the distance gas must be brought will create a limit to the potential displacement of oil by gas.

Natural gas can compete well with both oil and hydroelectricity for space heating. In a region that has low-cost hydroelectricity, partially due to tax advantages of government produced power, most homes have electric appliances. But industrial development will bring an additional increase in population in an already fast-growing region, and new homes will be equipped with gas appliances. About 8000 new homes a year are being built in Seattle alone. Homes still to be converted from wood or coal are likely to choose gas because gas appliances are less costly than electrical appliances. Natural gas is expected to make domestic inroads but it may do so gradually.

Generally, natural gas will complement electricity rather than compete with it. Whatever domestic winter-use load gas wins from electricity will help level peaks which have created shortages which have plagued the electric industry. Gas may be used to fire steam generating plants.

Natural gas will bring new industry. And while gas may be used directly in manufacture, possibly as an ingredient, such plants will also have use for hydro power to run motors and provide light. Gas cannot displace electricity for electrolytic processes. Conversely, it likely will stimulate electrolytic production by aiding in the finishing of products. Whatever business gas takes from electricity will be returned with interest in jobs for which electricity is best suited.

Seattle's float in the city's Seafair celebration depicted the journey of gas to the area.

4. Seattle Gas

LEADER in the fight to bring natural gas from the San Juan basin to the Pacific Northwest was Seattle Gas Co. and more particularly its dynamic president, N. Henry Gellert. As one of the two largest U. S. utilities in the area, it plans to take a substantial share of the natural gas for its service area. Its growth pattern, both past and prospective, is more or less typical of the group of utilities serving the area.

Seattle Gas serves the city of Seattle and King county. Within the company's service area boundaries, the population of approximately 631,000 is served by 1070 miles of main, with a total of approximately 37,000 meters.

The population of the area served represents 86.1% of the population of King county, or 94.3% of the Seattle metropolitan district—which consists of the city of Seattle and the thickly settled integrated area around the city with common economic and social interests.

For the 12 months ended June 30, 1954, total sales of manufactured gas amounted to 19,622,165 therms. This was divided by classes of service as follows: residential, 54.9%; commercial, 38.6%; industrial, 6.5%. Out of about 30,750 residential consumers, 6275 space heating customers accounted for 32.2% of total therms sold, as compared with 3300 space heating customers in 1944 who used 23.3% of total manufactured gas sold.

But with a supply of natural gas assured, the outlook for the market for gas in this area is radically changed. Whereas total gas energy increased only 26% during the past decade under manufactured gas, it is estimated that such sales will increase approximately 560% during the first five full years of natural gas. Annual sales of gas, presently 19.6 million therms, are estimated to rise to 129.2 million in the fifth full year after conversion to natural gas.

The approximately 37,000 customers served by Seattle Gas Co. are projected to increase to 70,180 annual average for the fifth full year of natural gas.

But in the face of existing conditions, even that 26% growth in the past decade has been gratifying. In 1941, when Henry Gellert took the helm, the company, then some 68 years old, was facing a financial debacle. It had already been through a reorganization in bankrupty in 1935, and its economic situation was still shaky. Dividend arrearages had piled up; its $70 preferred stock was selling as low as $5. Net income for the five years from 1936 to 1941 averaged only $37,650.

A steady advance through astute management of the company's affairs has lifted Seattle Gas to a point where net income for the 12 months ending last June 30 totaled $461,494, highest in history.

The change from manufactured to natural gas will mark the beginning of a new era for Seattle Gas.

The company has conducted careful market studies to determine the potential, and had them checked by an outside consultant. These studies, submitted as an exhibit in the FPC proceedings, are summarized in *Table 1*.

Of the projected increases in the residential class of service, the greatest gain is expected in the heating field, where a gain of 7000 customers a year has been forecast. This annual increase is based on 5000 new accounts plus the conversion to heating of 2000 present gas users.

Several factors support this predicted gain in load. Seattle and King county are rapidly growing in population. From 1940 to 1950 King county showed a population gain of 45.2% compared with a national average of 14.3%. Estimates of population growth indicate that the past rapid increases in population of this area will continue.

Seattle's mild, comparatively even climate is particularly suitable for gas space heating because it produces a certain amount of heating load even in the warmer months and reduces the peak heating requirements in the colder months. The normal annual number of degree days for Seattle is 4864 as compared with 3143 for San Francisco and 5304 for New York. However, San Francisco is the only other major United States city having a year-round heating season with a distribution of degree days throughout every month.

Continuing new housing construction on a large scale will be necessary in order to meet the promised increase in population. Future new housing construction is expected to be commensurate in amount with that of the past, which averaged over 5000 units per year during the 12-year period 1940

through 1951. For the years since the war, annual dwelling units constructed have ranged from 6000 to over 8000 a year. Much of this construction is in new outlying districts, which constitute an important type of market where the cost of installing gas services is less than in areas already settled where paving and sidewalks have been laid. A survey of local builders who recognize the economic advantage of installing gas space heating, and the ready acceptance of gas house heating in new residential construction experienced throughout the country were carefully considered in the market studies, which indicated that by the end of the fifth full year of natural gas, 21.7% of total residences would use gas for space heating as compared with 3.2% before conversion.

According to studies made by the Seattle *Times*, approximately 83% of Seattle homes are heated with oil at present. The price generally prevailing for diesel oil is 15.1 cents per gallon. This is the nature and extent of competition that natural gas faces in the domestic heating field.

Seattle has the lowest electric rates in the nation for a city its size, due principally to a municipally owned and operated electric utility, subsidized by tax advantages. Hence, the saturation of electric ranges and water heaters is exceptionally high. Consequently, the company does not expect any great increase in its domestic non-heating load.

The projected growth in commercial load is the expected result of the overall economic development of the area served by the Seattle Gas Co. Of the total commercial gains, substantial increases are contemplated in the heating category.

The potential industrial market for natural gas necessitated a comprehensive survey of existing fuel usage by present industrial firms. Future industrial development, due both to growth of the economy and to availability of natural gas for industrial processes, is also an important consideration. However, in the interests of conservatism, the industrial load included in the market studies is based on the estimated requirements of present industry.

Development of interruptible industrial load, so important for maintenance of load factor, necessitated a consideration of quantity and cost of current industrial fuel usage, and the location of individual firms for distribution system load studies. Projections for the fifth full year of natural gas indicate that of the 48.6 million therms of industrial annual sales, 77.5% will be on an interruptible basis.

Diversification of industry has characterized the industrial development of the Seattle area throughout its history, insuring economic protection and stability of earning power to labor engaged in manufacturing. Also, Seattle is basically an area of small industries, further insuring stability of earning power.

Regarding the impact of the introduction of natural gas into this area on the demand for electrical energy, Bernhard Goldhammer, economist for the Bonneville Power Administration, made the following statement:

"Importation of natural gas into the Pacific Northwest could materially increase electric power requirements. Introduction of additional fuels in this fuel-starved region will tend to complement rather than substitute for hydroelectric power. The extent of the effect on the electrical power requirements will depend to a large extent on the quantity of gas available and the price. A relatively lower price with a large supply would result in a substantial expansion of electric power requirements.

". . . Industry in general requires energy for heat and steam for mechanical power in driving motors and for electricity in electrolytic and chemical processes. The highest use of each of these fuels in the plant will provide the greatest efficiency and also the largest employment and income. If we can use natural gas for thermal energy we will be able to move more of the electric energy up a step on the technological ladder, and use it in chemical processes. In this manner we will secure the highest possible use of all resources."

TABLE 1. GAS SALES
(Thousands of Therms)

	12 Months Ended June 30, 1954	Estimated for Fifth Full Year of Natural Gas	Per Cent Increase
Residential	10,769	62,328	478.8
Commercial	7,573	18,307	141.7
Industrial	1,280	48,612	3,697.8
Total	19,622	129,247	558.7
Average Number of Customers			
	12 Months Ended June 30, 1954	Estimated for Fifth Full Year of Natural Gas	Per Cent Increase
Residential	30,747	58,840	91.4
Commercial	5,994	11,040	84.2
Industrial	106	300	183.0
Total	36,847	70,180	90.5

5. Cascade Natural

"INQUIRIES we are receiving from companies wishing to build plants in the Pacific Northwest," says Stewart Matthews, president of Cascade Natural Gas Corp., "indicate that cities served by our company can expect a phenomenal growth."

Cascade Natural Gas was incorporated in 1953. It acquired Bremerton Gas Co., and Northwest Cities Gas Co. was merged into the new company. Northwest operated gas utilities in Yakima, Walla Walla, and Clarkston in Washington; Lewiston, Idaho; and Pendleton and Eugene-Springfield, Ore. Bellingham and Wenatchee Gas Cos will be merged into Cascade later this year and merger proceedings have been started which will add the properties of Consolidated Gas Co. at Grandview, Granger, Prosser, Sunnyside, Toppenish, and Zillah in the Yakima Valley. Cascade has applied for franchises in Ellensburg, the Tri-Cities (Pasco, Kennewick, Richland), Wash., and several other small cities near the company's present service areas.

At present the combined companies serve about 600,000 population. Of the cities served, Yakima, in the fruit-growing section of central Washington, is the largest with 40,500.

Cascade has 315 miles of main now, but the management expects to invest from $12 million to $17 million to expand the company's utility properties, depending upon how many new franchises are acquired.

A substantial increase is expected in

the company's heating load, but the most spectacular gains are expected for the industrial load. Mr. Matthews, evaluating preliminary discussions with industrialists, sees a potential industrial load of 45 MMcf per day within 10 years after natural gas is available. About 75% of this would be interruptible. One customer has asked Cascade for 4 MMcf per day.

The company now sells about 475 MMcf of manufactured and L. P. gas-air per year, but it expects to sell about 7.1 billion cu ft per year in the third year of natural gas service. The number of customers is expected to increase from 11,000 to about 40,000.

Many industries that are likely to use large volumes of gas are already located in Cascade territory. The Puget Sound Naval Shipyard at Bremerton probably will be the largest users. There are wood derivative industries in the area now, and central and southeastern Washington have many food processing plants, particularly vegetable and fruit canneries. Extrusion of aluminum to finished products could take place at Wenatchee where Alcoa has a plant. Cement and chemical plants are established and several new fertilizer, ceramic and chemical plants are about to locate in or near Cascade's inland cities.

Washington Gas & Electric Co., which now distributes manufactured gas in Tacoma, Olympia, Tumwater, Everett, Centralia, Chehalis, Auburn, Puyallup, and Sumner, also is aware of a tremendous potential for industrial sales in its area.

But Bernard T. Poor, vice president and general manager of Washington Gas, believes distributing companies must work hard and rapidly to earn and keep the waiting industrial load.

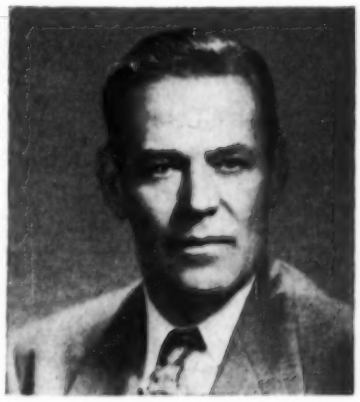
"We must make every effort to sell the advantages of gas to all customers, domestic, commercial, and industrial, as soon as it is available," Mr. Poor says. "If we insure the health of the pipeline project by our initial sales efforts, we avoid later rate increases. Even small increases after our industrial service is begun could cause us to lose some interruptible customers."

There is plenty of room for load building accomplishments, Washington Gas' managers believe. There are fewer meters per capita in the company's area than in the rest of the United States. But, significantly, the average use of those customers of manufactured gas is greater than most anywhere else.

About 250,000 persons live in the area served by Washington Gas & Electric and about 150,000 of those are in Tacoma, the company's headquarters city. It has about 13,200 manufactured gas customers and that number is expected to double.

The company's present annual sendout of gas is about 5,504,000 therms. Five years of natural gas is expected to boost that total to 47 million therms. Firm industrial sales will increase 16 times, company experts estimate.

Dispersion of industry from metropolitan target areas is looked upon as a most significant development by Allen Peyser, president and general counsel of Washington Gas & Electric. "Eighty-



Cascade's Stewart Matthews expects "phenomenal growth."

five percent of all factory construction since the Korean war, involving many billions of dollars, has been in areas such as we serve," he explains.

Following changeover, existing gas manufacturing facilities will be used for peak shaving. Even more important, they can be used to take additional load not previously known about, up to about 35% of estimated peak day requirements.

About $6 million will be invested in new plants in the first five years of natural gas.

Spokane Gas & Fuel Co. expects to expand rapidly when natural gas comes to the capital of the Inland Empire, and it has a special reason for anticipating the advent of the new fuel.

Spokane, and other inland cities, have long suffered industrially as the result of various cost differentials existing between the coastal areas of Washington and Oregon and the area lying between the Cascade and the Rocky mountains. But natural gas at the same load factor will cost no more at the Spokane city gate than anywhere else in the state.

Besides the important industrial potential in the area, which natural gas will help develop, the company has much physical room for expansion. At present the firm has distribution mains in about half of the area within Spokane's city limits, which contains about 175,000 persons, and about 8000 present customers. It also has franchises to distribute gas through the fast-growing Spokane valley, which is building a sizeable industrial complex.

Spokane Gas' expansion plans call for the investment of about $6 million to lay mains throughout the city and valley. Several potentially large users of natural gas are already located in the valley, including Washington Brick and Lime, Spokane Portland Cement Co., the Inland Empire Paper Co., and the Kaiser Aluminum & Chemical Corp.

The company has a present annual sendout of 350 MMcf of 650-Btu gas. In the third year of natural gas, the management expects to sell 27 MMcf per day to about 25,000 customers in an area with about 200,000 total population.

Contracts recently signed with distributors by Pacific Northwest Pipeline include three companies confined to single market areas.

Twin Cities Gas Co., which annually has been serving 16,990 Mcf of 1200-Btu gas to 642 customers at Longview-Kelso, is expected to sell 788,373 Mcf in the third year of natural gas service.

The United Gas Corp., operating in the Camas-Washougal area, now sells annually 24,710 Mcf of 1100-Btu butane gas to 747 customers. Its estimated annual volume of sales in the third year of natural gas is 328,743 Mcf.

California-Pacific Power Co., which owns distribution properties in La-Grande, Ore., is expected to take about 207 MMcf in the third year.

Of all the area served by Pacific Northwest, south Idaho has the most unsettled distribution picture at the present time. Southern Idaho does not now have any manufactured gas utilities, so brand new systems must be installed in 30 south Idaho counties, which contain about 300,000 persons.

Idaho's Public Utility Commission will conduct a hearing Sept. 13 on the applications of several concerns proposing to distribute natural gas to all or parts of southern Idaho. Potential applicants to date are Intermountain Gas Co., Idaho Natural Gas Co., Pocatello Natural Gas Co., and Idaho Power Co. Others may make late filings.

GAS exclusive

Can a domestic gas meter's accuracy be improved?

Here's a fast, comprehensive way of finding out

By **ED GILMORE** • Lancaster Meter Parts Co., Lancaster, Ohio

IT IS possible to determine by a fast, comprehensive method whether domestic gas meter accuracies at a specific property can be improved.

The first step requires the obtaining of adequate information on the existing accuracy and condition of the meters in service. The incoming meters for one month should give a representative supply of meters for a fair study.

The Incoming Proof Circle Analysis Chart *(Fig. 1)* takes into consideration the check, capacity and average accuracy as well as the variation in proof. The variation of the proof at different rates of flow indicates as much, if not more, about the condition of the meter than does the check, capacity or average proof. A meter in good condition will measure gas accurately for many years. The accuracy of a meter in poor mechanical condition is uncertain for even a brief period of time.

Fig. 1 provides a means of picking out the meters in poor condition and giving a graphic picture of overall meter conditions and accuracies. Example:

Meter proof at capacity rate, 3% slow.

Meter proof at 1/5 capacity rate, 1% fast.

Average of capacity and check proofs, 1% slow.

Spread between proofs at the two flows, 4%.

Check rate proof is faster than capacity rate proof by 4%.

This meter would be classified as an "OK" meter in many standard summaries which use only one test for determining the classification. It would also fall in the OK group if an average test were used. But the mechanical condition of any meter with a spread of 4% between the capacity and check rate of flow proof is very doubtful.

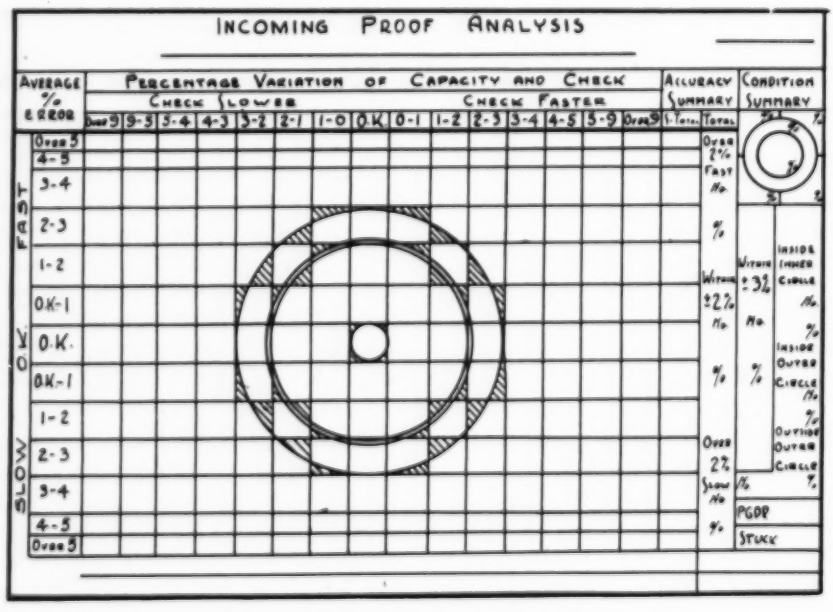


Fig. 1. Incoming proof analysis.

Result of analysis

The Incoming Proof Circle Analysis throws this meter out of the OK group. The meter falls in the square horizontally in line with OK-1 slow and vertically below the 3-4 variation, in the check faster than capacity section. This is outside the most lenient limits.

After all the meters under consideration are plotted, the accuracy and condition summaries, shown at the right of the chart, should be completed.

The meters falling within the 2% average proof-2% variation circle can be safely considered as meters in good mechanical condition. Occasionally a meter in bad condition will be found in this group.

Fair condition

The meters between the two large rings are in fair condition. They should be included with the meters outside the circle for further investigation if time permits.

Sufficient information can generally be obtained from a study of the individual meters outside the circles. The meters not meeting the circle requirements should be summarized in the four groups as shown on the chart. After the complete investigation has been made it will be found that like faults exist in the meters in a particular corner. This information will be helpful in future studies as it can be told by a quick glance at the chart what is probably wrong with the meters without further investigation.

If in the overall picture portrayed by the chart a majority of the meters are toward one corner, the faults found in the meters checked from that corner should be given prime consideration.

A change in the trend in future studies is quickly detected by any shift of the mass of the meters on the chart.

The trend may change because of operating or gas condition as well as changes in repair procedures. Indications of troubles caused by gas conditions and operating conditions should be given due consideration in the investigation of the condition of the individual meters.

Meter investigation

Each meter failing outside the circles should be investigated for causes of its failure to meet the standards expected in service.

The points which should be checked are listed in the general order in which they will occur in checking the meter and not in the order of their importance.

1. The index and all the drive mechanism from the crank, including stuffing box and bearings, should be checked for binds, alignment, wear and chemical action of gas.

2. The coordination of the valves with the diaphragm should be noted. This requires a check of each valve position in respect to its seat at each of the extreme positions of the diaphragm, which it controls. As the mechanism is rotated for this check, binds, wear and chemical action of the gas on the parts should be noted.

Improper coordination of the valves and diaphragms can throw the meter out of balance causing excess wear. Such meters are difficult to prove and hold in proof. The reason for the poor coordination will be found as the investigation proceeds.

3. Note the length of the tangent. Every make and size of meter has a standard length of tangent for a specific type of diaphragm. If the tangent length varies over 3% from standard the meter was originally adjusted to compensate for some error which had been built into it. Check the tangent post for tip and wear.

4. Check the timing of the meter as nearly as possible even though the valves are not coordinated as well as they should be. If the timing is not standard it may be off because of wear or it may have been set off originally to compensate for some fault in the meter when it was proved. Check the valve links for wear as well as the valve seats and guides. The seat surfaces should be investigated for foreign matter. If any is found its source should be traced if possible.

Flag arm settings

5. Check the flag arm settings for proper division of the diaphragm stroke. A general rule to follow on all kinds, types and sizes of meters is to have a minimum amount of clearance at the "in" extreme stroke. Most leather diaphragms give the greatest amount of uniform displacement for the least amount of unrestricted movement starting from an "in" or closed position.

6. All packing boxes should be checked for binds and any change from the original friction should be noted. All stuffing boxes should be packed lightly with a packing which acts as a lubricant as well as a seal. Many meters use the packing as a bearing.

Center of rotation

7. Every meter has a center of rotation about which the mechanism moves. It is important that this central axis be properly located in the body or case of the meter. The stationary parts of the assembly, which help to produce the movement of the mechanism, must be located correctly in respect to this axis.

Cranks for the valve or valves and the diaphragms are attached to this axis shaft. The shaft has two and sometimes three bearing points. At least one and sometimes two of these bearings are movable. These must be located to hold the axis equidistant from the flag rods (carrier wire side bracket, on meters with the main mechanism in the body) equidistant from the valve seats, and also equidistant from the fixed-edge plane of the diaphragms which is parallel to the central plane of the meter.

The length of the linkage must be right to obtain the desired results. Adjustable valve links provide a means of setting each valve so that it will be at the center of its seat each 180° turn of the tangent. This setting does not coordinate the valve with the other valve nor with the diaphragm it controls unless the flag rods

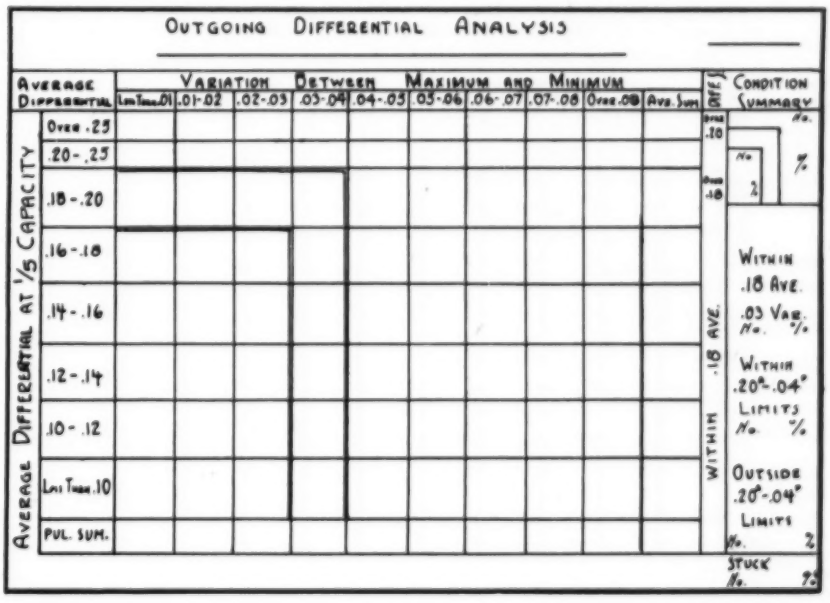


Fig. 2. Outgoing differential analysis.

Mr. Gilmore, who is chief engineer for Lancaster Meter Parts Co., is a graduate of Renselaer Polytechnic Institute. Before joining Lancaster in 1951, he served as a gas engineer and superintendent at various distribution properties of the Cities Service Gas Co. and with Rockwell Manufacturing Co. He has done considerable work in the positive displacement meter field and is a veteran instructor at the gas measurement short courses.

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and valve seats are located angularly correct about the center of rotation.

8. The diaphragm oil condition should be noted by squeezing a fold in the leather lightly. If oil comes to the surface there is sufficient oil to preserve and seal the leather for another period of service.

In checking the diaphragm for tightness do not apply more than 2 in. water pressure across the leather.

In examining the diaphragm for wear, investigate the points where sharp V-shaped wrinkles have formed.

Be sure there is enough flexible material in the diaphragm to permit a full, unrestricted stroke.

The diaphragm center pan should be in the center of the diaphragm at both extreme strokes. Incorrect alignment of flags, rocket shafts, diaphragm support, carrier wires, the pans themselves, and uneven leathers can cause a deviation at these points. The lengths of the flags or carrier wires have great bearing on the center pan location at diaphragm extremes and throughout its stroke.

9. A summary should be made of the conditions found, at the points outlined, for all the meters in each section of the out-of-limits area of the Incoming Proof Circle Analysis.

Before any attempt is made to correct the faults found in the investigation, the same number of new or newly repaired meters as was included in the incoming analysis should be selected and studied.

The differential test gives an excellent indication of the condition of a meter. This test should be standard practice for every meter shop for all outgoing meters.

The recorded differential of a meter as produced by the cardiograph* provides an ideal means of studying meter operation and analyzing its condition. However, any draft gauge can be used satisfactorily, if proper records are made and correctly interpreted.

The 1/5th capacity rate of flow can be used to best advantage. A record of the highest and lowest differential should be made. From these readings it is possible to obtain a fair picture of the condition of one meter and the condition of the meters in general by using the Outgoing Differential Analysis chart *(Fig. 2)*.

This chart has been devised to classify and summarize outgoing meters according to differential similar to the classification obtained with incoming meters using Incoming Proof Circle Analysis chart.

The outgoing meters selected should be plotted on this chart and summarized as shown on the chart. Example:

Maximum differential reading at 1/5 capacity, .20 in.

Minimum differential reading at 1/5 capacity, .15 in.

Average maximum and minimum readings, .175 in.

Variation between readings, .05 in.

This meter when plotted on the chart would fall in the square horizontally in line with the .16-.18 average and vertically in line with the .04-.05 variation.

The limits set upon this chart are shown by the double line. The larger rectangle has been found to be very practical for the average shop limits. The condition of meters outside these limits is poor and the meters require further attention before being placed in service.

Each meter failing the differential test should be investigated in the same manner as those failing the incoming proof test.

Summarize the troubles found in the outgoing meters the same as was done in the incoming meter analysis.

Comparison of incoming and outgoing meter studies

Check the percentage of incoming "off proof" meters against the "off differential" percentage of the outgoing meters. These percentages are generally found to be of nearly the same magnitude.

Check the incoming meter faults to determine whether they are being caused by faults that exist in the outgoing meters. The incoming meter troubles can usually be traced to faults existing in the outgoing meters.

Correction of difficulties found

Once the troubles have been brought to light they can be corrected at little or no expense.

To prevent recurrence of these troubles, set up differential test standards that are rigid enough to detect these faults. When these standards are set up, both the maximum and minimum readings must be observed. Instruct the men in interpreting the speed and frequency of the fluctuations of the differential gauge. The observers should also be aware of the type of graph of the differential for each type of meter, so as to know what the typical fluctuation of the gauge for that type of meter should be.

The limits that are set up should take all these points into consideration and be broad enough to cover the field but rigid enough to catch the troubles in the meters. The limits selected should be based on the findings in each particular study.

Summary

If all the meters in both studies fall within the accepted limits it is very fortunate and there is little to worry about regarding meter accuracies.

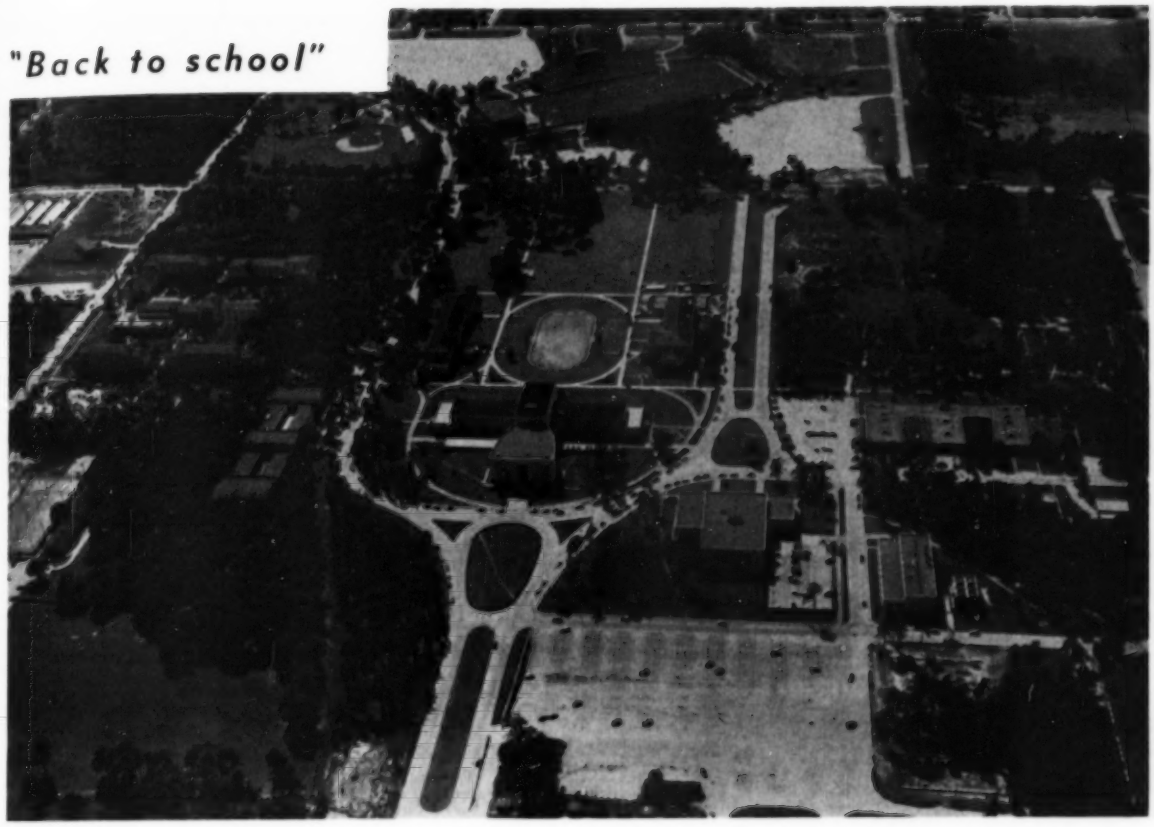
If only 5% of the meters fall outside the limits a complete study will be worthwhile.

If over 15% are outside the limits a complete study is imperative.

The discrepancy in the measurement being considered deals with sales price gas regardless of whether or not it appears on the books as "Lost and unaccounted-for gas" at a purchase price cost.

*See "Analysis With Cardiographs Diagnoses Meter Problems," by Mr. Gilmore in the April 1953 issue of GAS.

"Back to school"



University of Houston spawns gas engineers in the heart of the petroleum producing country

Just as in former years segments of the natural gas industry were considered a part of the petroleum industry, and the talent within gas utility and pipeline companies gravitated there from the oil fields, or chemical fields, or from the electric side of a combination company, so has the formal education in the specialized field of gas engineering been subordinated as a part of petroleum or general engineering courses to a considerable extent. Most men in the gas industry hold chemical, or mechanical, or even electrical engineering degrees.

There has been no revolution in the field of gas engineering education. But there has been change and evolution over the years as the industry has grown in stature. Today several top-flight universities offer courses especially wrought to provide the budding gasman with the kind of education that will best fit him for his choesn career.

There are yet but a handful—only eight, according to available records; and the scope of training offered varies greatly from one to another.

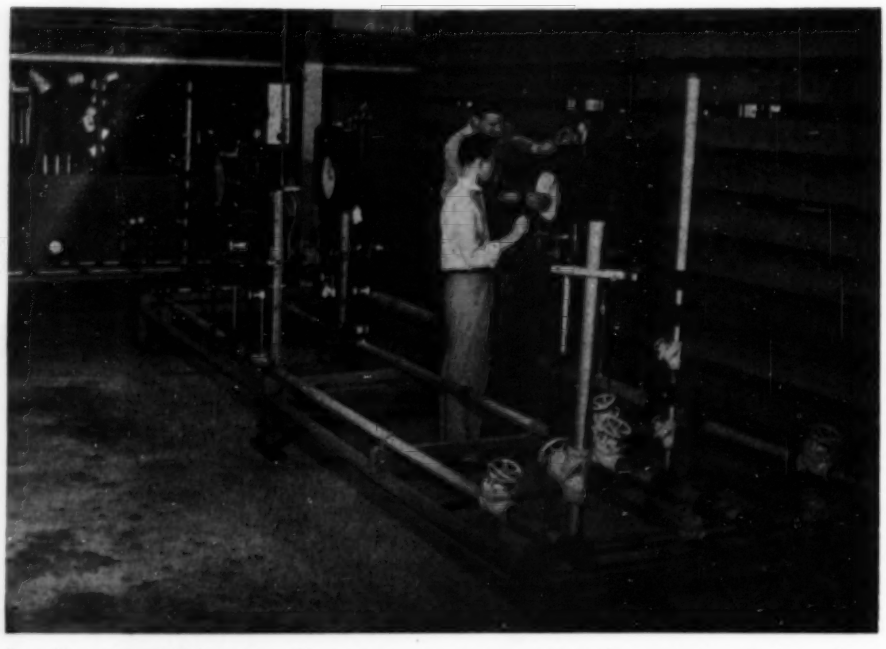
At this time of the year, many younger men already in the industry but desirous of expanding their knowledge of the fuel and the industry are toying with the thought of "going back to school." In this brief series, GAS highlights the curricula of several of the most prominent universities that present gas engineering courses.

SITUATED in the mecca of the oil industry, the largest city in the south and the industrial frontier of the nation, the University of Houston is growing daily in order to meet the training demands of industry.

One of the major objectives of the university has been to provide an educational program that will serve public welfare constructively as well as developing the maximum abilities in each student. Each phase of the curriculum has been developed as a direct result of community basic need or demand. In addition, each course of study is geared to enable the student to later earn a living and to make the greatest contribution to the community.

The second largest university in the state, the university of Houston was

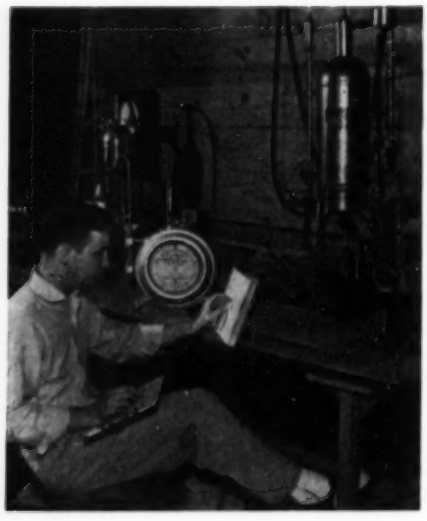
GAS exclusive



A well-equipped laboratory offers students the opportunity for extensive study and experimentation. Here two engineering students are running an experiment in the study of the operation and design of an orifice meter installation.

Richard Ray, a petroleum engineering student (left), receives instructions from C. V. Kirkpatrick, professor of petroleum engineering, on the operation of an integrating type orifice meter.

Two students experimenting with the proving of positive displacement meters using a Bell-type prover.



Ralph K. Hammond is checking his textbook on how to run a calorimeter test of the Btu content of natural gas.

established as a four-year institution in June 1934, beginning full-time operations in the petroleum engineering department in September 1947. In the summer of 1948, three petroleum engineers received their degrees, and in 1953 more than 25 students were graduated in that field. The present enrollment in that department is approximately 250 students.

Prerequisites

An important part of the petroleum engineering curriculum is gas engineering. Students with a major in this subject receive a degree in petroleum engineering, with prerequisites including six semester hours of introductory petroleum engineering, math through integral calculus, statics, dynamics, and 12 hours of geology.

The petroleum curriculum offers an extensive four-year course in petroleum development or production with emphasis upon engineering fundamentals and petroleum geology.

This degree includes one specific course in gas engineering, consisting essentially of production and transportation of gas, a study of positive and orifice metering methods, a study of regulators, estimation of gas reserves, determination of gas well capacities, and deliverabilities and utilization of gas.

Other courses are Development II, involving a study of the development and production of natural gas and condensate reservoirs and leases. This also brings in the study of fundamental principles of developing and producing natural gas expansion and (or) water encroachment.

Some other courses are production II (lifting methods), and conservation and economics of oil and gas development and production.

In addition to these courses, a very up-to-date laboratory has been established covering all of the important areas of gas measurement and physical properties of natural gas. Special subjects stressed in the lab work are complete measurement practices, testing accuracy and capacity regulators, gas analysis and gas gravity determination. Among other topics covered are gas dewpoint, proof of calibration and orifice and positive type of meter displacement, design and operation of orifice meter runs and calorific determination of gas.

Two months' field work is required

for graduation and elective hour credit (up to six hours) is given for this job. Most of the necessary courses are offered during the summer, although a large group of students do their field work during that time.

Special emphasis is placed upon the night school, and more than 30% of the total enrollment at the university is composed of night students who work full time on regular day jobs. This night program further enables graduate students who are employed in the area to pursue advanced degrees.

Heavily represented among the night group are employees of a large number of oil and gas companies that have offices in Houston, including Humble Oil & Refining Co., Tennessee Gas Transmission Co., Transcontinental Gas Pipeline Corp., The Texas Co. and others.

The faculty in the petroleum department consists of C. V. Kirkpatrick, associate professor of petroleum engineering and chairman of the department, and R. P. Sterk as full time staff members. Members of the part-time faculty are Park Jones, consultant and reservoir specialist; A. S. Trube, reservoir engineer for Tide Water Associated Oil Co.; T. E. Griffith of Tide Water Associated Oil Co.; R. P. Akkerman, geologist with Gulf Oil Corp.; and B. Q. Green, engineer in charge of the Magcobar trainee program.

These men are all experienced in their particular field of industry and the majority of them have had four years of teaching at the university.

Placement center

Possibly one of the busiest and most active departments at the University of Houston is the placement center, headed by Miss Lou Russell. An enthusiastic participant in personnel organizations throughout the country, Miss Russell has a high record for placing students in top-flight positions in companies all over the United States.

Students interested in getting jobs are interviewed by a member of the placement staff, after filling out a complete information blank. From this the placement center compiles a "blue book" of pertinent facts about each student.

Personnel representatives are invited to the campus for interviews with prospective employees. Usually a company representative will visit the campus two or three days during a year, at which time he has scheduled appointments throughout the day, and receives a copy of the "blue book" for his files.

Screening students

Other methods of operation in the placement center include screening of students by the various department heads before a student ever reaches the placement center, and individual contact by a student directly with an employer.

Miss Russell has maintained a high reputation for her cooperation with companies in placement of students and and providing necessary information for employers. The University of Houston has one of the highest records in the country for placement of its graduates in the petroleum engineering field. In addition to this there are more than 20 university alumni now employed by local gas utilities.

Although the University of Houston

is one of the largest in enrollment in the South, it is one of the youngest in years, having been established as a junior college a slight 26 years ago in 1927. The university became a four-year institution in June 1934.

Much of the progress and expansion of the university is due to the philanthropy of Houston Oilman Hugh Roy Cullen, who has given approximately $15 million in buildings and oil leases to the school.

Located on a 250-acre tract in the southeast section of Houston, the university is co-educational, having a total enrollment of 13,361 students in the fall of 1953. Of this number 11,975 are resident students and 1386 are extension or correspondence students.

Next month

University of Michigan, with sidelights on studies available at Purdue.

Columbia touches gas engineering

ALTHOUGH listed as one of the eight schools offering gas engineering courses, Columbia University, New York, confesses that gas engineering is not "one of our strong points." The university has two courses under the department of chemical engineering that touch on gas engineering, but neither is being given this year. The course descriptions are as follows.

Chemical Enginneering R265 — Fuel Technology and the combustion of solid, liquid, and gaseous fuels. The study of the combustion of solid, liquid, and gaseous fuels from the point of view of thermodynamics, kinetics, and practice. Problems of combustion power cycles are considered and handled by means of thermodynamic charts. Prerequisite: Chemical Engineering 102 and Chemistry 44.

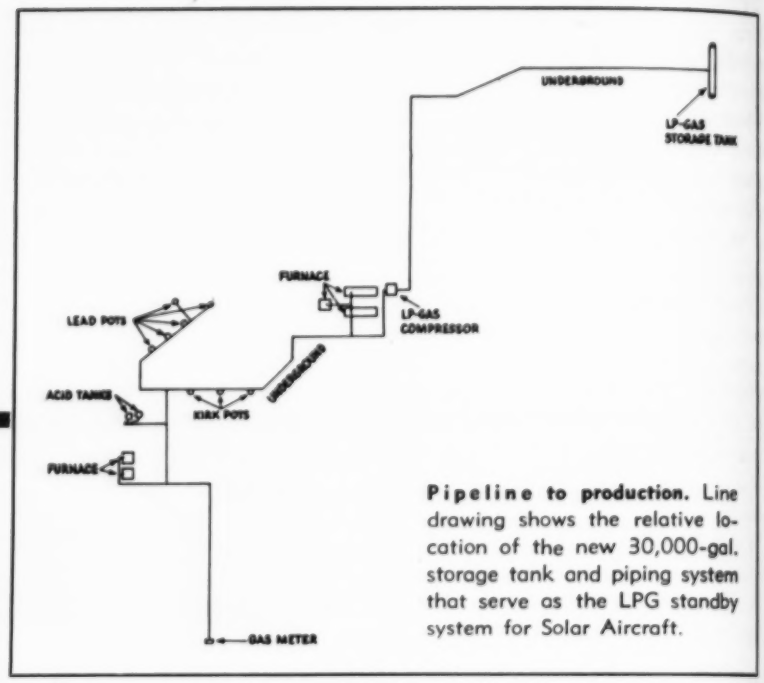
Chemical Engineering 268—Fuel Technology, II: Petroleum. This course is designed to supplement Chemical Engineering 265 but may be taken separately. The course treats in general of the importance, origin, and occurrence of fuels and in particular of the winning, refining, and marketing of petroleum and its products. It includes discussions of the theories of heat transfer, of fractional distillation and condensation, and of cracking of hydrocarbons in their applications to refinery practice; petroleum and natural gas as chemical raw materials; oil shales and other sources of liquid fuels; and the utilization of liquid fuels. Prerequisites: Chemistry 44 and Chemical Engineering 102.

In Mechanical Engineering, Columbia is strong in heat transfer work and the course described below is one of a series in that area:

Mechanical Engineering 214 — Gas heat transfer processes. Quantitative consideration of heat transfer involving low, medium, and high pressure gases. Combustion processes, combustion chamber design; regenerators and intercoolers, and other gas turbine plant heat transfer components; blade cooling. Gas-to-gas heat exchange problems of aircraft, electronic equipment, gas-cycle refrigeration, gas separation, and liquefaction processes. Temperature aspects; special materials of construction.

Unique LPG standby hookup assures uninterrupted changeover

At Solar Aircraft plant, pressure differential locks off natural gas flow, permits automatic reversion to utility supply in case of failure in standby system.

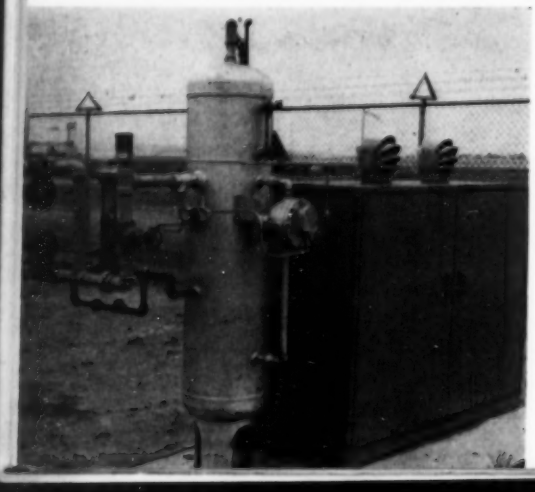


Pipeline to production. Line drawing shows the relative location of the new 30,000-gal. storage tank and piping system that serve as the LPG standby system for Solar Aircraft.

A RADICAL departure from the conventional method of installation has brought unusual advantages to the L. P. gas standby system of Solar Aircraft Co. in San Diego, Calif. Starting with a 30,000-gal. storage tank, the system supplies approximately 75% of the total gas used when the plant is operating on a standby basis.

The system was engineered and installed by American Liquid Gas Corp. of Los Angeles, pioneers in utilization of LPG for industry, who worked in cooperation with the industrial sales division of the San Diego Gas & Electric Co., San Diego Fire department, and the San Diego Harbor commission.

This 300-gal. water heater type vaporizer is part of the LPG standby system installed at Solar Aircraft Co. by American Liquid Gas Co. and San Diego Gas & Electric.



LPG recommended

Officials of the gas company recommended that L. P. gas be delivered into the plant distribution system at one or two pounds higher pressure than natural gas in order to expedite the changeover from natural gas to LPG fuel. When it is necessary to change to standby operation the L. P. gas system is started and the fuel is introduced to the plant gas piping system being served by liquefied petroleum gas. As the higher pressure of the LPG enters the line it stops the flow of natural gas, locking off the natural gas company's regulator.

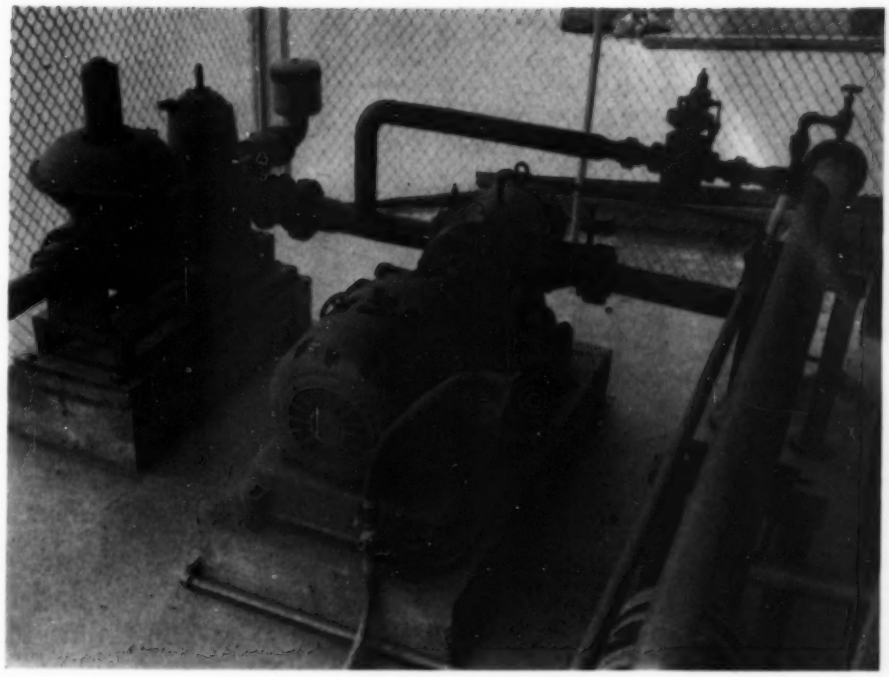
When it is desired to again revert to the use of natural gas, it is necessary simply to close the valve that connects the standby plant to the piping system and the natural gas comes right back into the system and the plant.

This unusual arrangement provides a safety feature that is not normally obtained with other arrangements, particularly those that employ the use of the three-way valve. Under this system if the standby plant should stop because of electrical or mechanical failures, the natural gas would immediately enter the line and no burner or pilot light failures could occur.

Undiluted propane vapors

From the storage tank the fuel is brought into a 300-gal. vaporizer, water heater type. From here the undiluted propane vapors are brought into the plant at 15 psi in 2½-in. to 3-in. pipelines. They are then diluted with air in a Selas combustion controller to 1500 Btu. This mixture is delivered into the plant distribution system at 15 psi,

Fuller compressor that operates Selas combustion controller. At this point, the pure propane vapors are diluted to 1500 Btu and delivered into the plant's piping system.



which is a higher pressure than that of the natural gas.

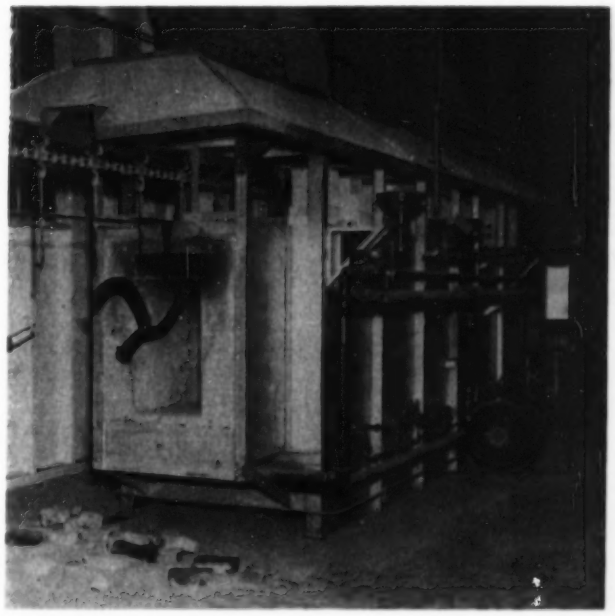
While the entire Solar plant does not switch to the use of L. P. gas during the standby periods, approximately 75% of the load is converted to LPG and most of the heating ovens, furnaces, acid tanks and lead melting pots are connected to the system.

Perhaps one of the most interesting and important operations that utilize the standby system is that known as Solaramic coating. Solaramic is an exclusive Solar process of applying ceramic coatings to aircraft engine components, where high temperature oxidation and corrosion is a serious problem.

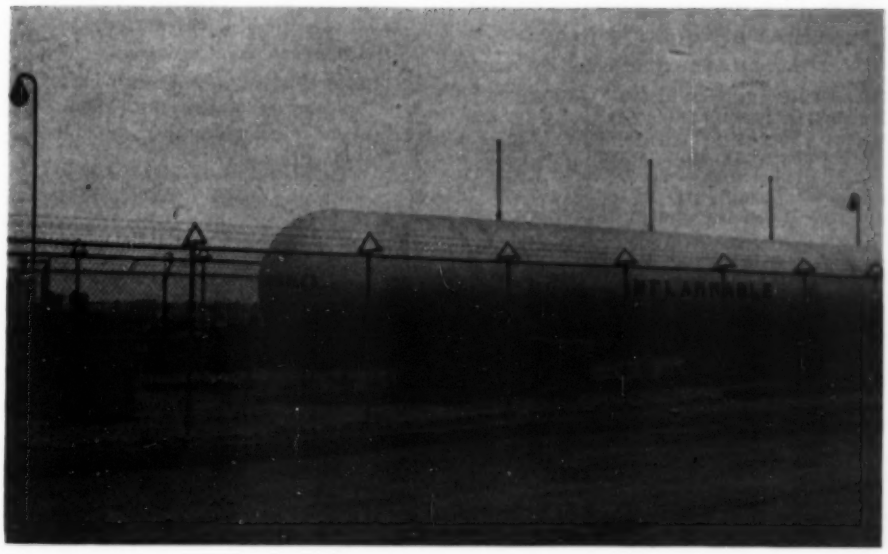
Weapon against oxidation

Solaramic coatings give every user of high or low alloy steels a new weapon against oxidation or corrosion. They can protect against heat, up to 2150° F. They can resist boiling acids. They can sharply reduce abrasion and wear. They guard against corrosion by alkalies, salts, liquors, hot gases and combustion products. They protect dielectrically. In brief, Solaramic coatings can cut costs substantially by lengthening the life of metal parts.

Research on ceramic coatings was begun more than 10 years ago by Solar and today it has developed a group of coatings for various needs. It is not uncommon to have as much as $30,000 or $40,000 worth of manifolds or other parts going through the Solaramic ovens at one time, which means that it is extremely important that there is a positive supply of fuel at all times to provide heat for the ovens. L. P. gas used on a standby basis makes sure that the Solar ovens can be kept operating whether the natural gas supply is cut off for economic reasons or whether service may be interrupted because of emergency factors. In other departments, too, L. P. gas plays an important part in the huge Solar plant, making sure that production is continued on schedule.



Huge ceramic oven is just one of the many important uses for LPG when Solar converts to standby operation.

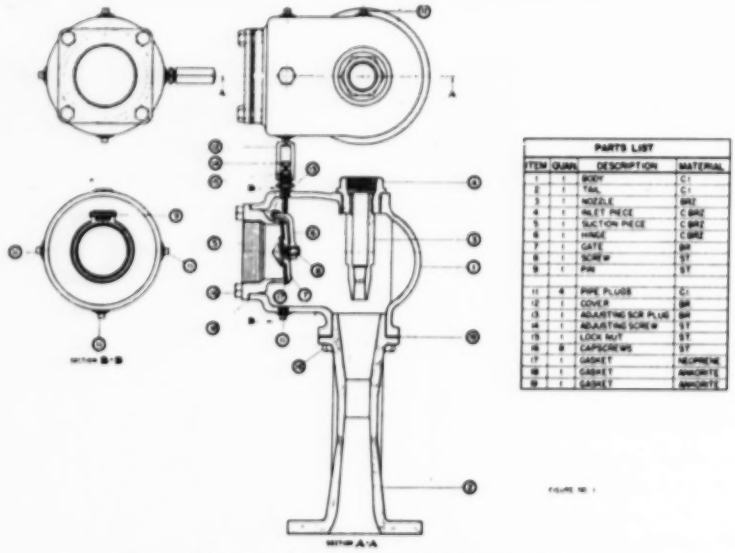


This 30,000-gal. storage tank supplies fuel for approximately 30 days at Solar. Approximately 75% of the fuel load of the plant is connection to the LPG system.

Gas mixing with jet compressors:

A study of design, performance and application

By C. W. WARNER, Engineering Supervisor • Cutler-Hammer Inc., Milwaukee



PARTS LIST			
ITEM	QUAN.	DESCRIPTION	MATERIAL
1	1	BODY	C1
2	1	TAIL	C1
3	1	NOZZLE	BRZ
4	1	INLET PIECE	C BRZ
5	1	SUCTION PIECE	C BRZ
6	1	HINGE	C BRZ
7	1	GATE	BR
8	1	SCREW	ST
9	1	PIN	ST
11	4	PIPE PLUGS	CI
12	1	COVER	BR
13	1	ADJUSTING SCR PLUG	BR
14	1	ADJUSTING SCREW	ST
15	1	LOCK NUT	ST
16	8	CAPSCREWS	ST
17	1	GASKET	NEOPRENE
18	1	GASKET	ANNORITE
19	1	GASKET	ANNORITE

Fig. 1. Cross section of a typical jet compressor.

WHEREVER gas is available at high pressure, there is the desire to use the stored energy represented by the pressure to do useful work. In many gas utility and industrial gas applications, this work is to pump air or another gas to produce a required mixed gas.

The use of the energy in a high pressure gas to pump another gaseous medium from a low pressure to some intermediate pressure has taken a number of forms. Several of these are as follows:

1. *The Power Mixer.* This type of equipment consists essentially of a turbine mounted on the same shaft with a centrifugal compressor and housed in a common casing. Natural gas is used to drive the turbine, which, in turn, operates the centrifugal compressor to pump the low pressure manufactured gas. The compressed gas and exhaust from the turbine are then mixed to produce the desired final gas.

2. *The Expander Type Engine.* In this method, a horizontal steam engine compressor, with the steam cylinders designed for the expansion of natural gas as a motive power and the compressor cylinders designed to compress the low pressure gas, is used. The exhaust from the power cylinders is then mixed with the discharge from the compressor cylinders to form the sendout.

3. *Jet Compressor.* In this equipment, high pressure gas is expanded through a nozzle resulting in a high velocity flow. The high velocity gas entrains and increases the velocity of the low pressure gas entering the suction chamber. The mixed gas then enters the diffuser section where the velocity is converted into discharge pressure.

Let us examine jet compressor design and performance, and consider several typical applications to gas mixing problems. The information presented represents a summary of experience gained through a number of years of using this type of equipment.

Fig. 1 shows the cross section of a typical jet compressor. The obvious feature of this type of compressor is the absence of any moving parts. The check valve, which is an integral part of this particular design, can rightfully be considered an auxiliary device.

To understand the operation of the unit, it may help to consider the pressure of the gas delivered to the nozzle as representing a form of potential energy. In operation, gas is delivered at a fixed high pressure (usually in the range from 25 to 100 psig) to the inlet piece, Item 4. The high pressure gas then flows into the nozzle, Item 3, and through the nozzle orifice. This nozzle orifice is, of course, the general flow-determining device, since for fixed conditions of pressure, temperature, degree of saturation and density, the orifice opening will determine the flow. After leaving the nozzle orifice, the gas expands to a relatively low pressure through the diverging section of the nozzle to the nozzle opening and then into the converging section of the tail. (Tail piece is Item 2.)

This expansion will result in a high

This article has been adapted from a talk presented at the chemical engineering and manufactured gas production conference in Pittsburgh in May.

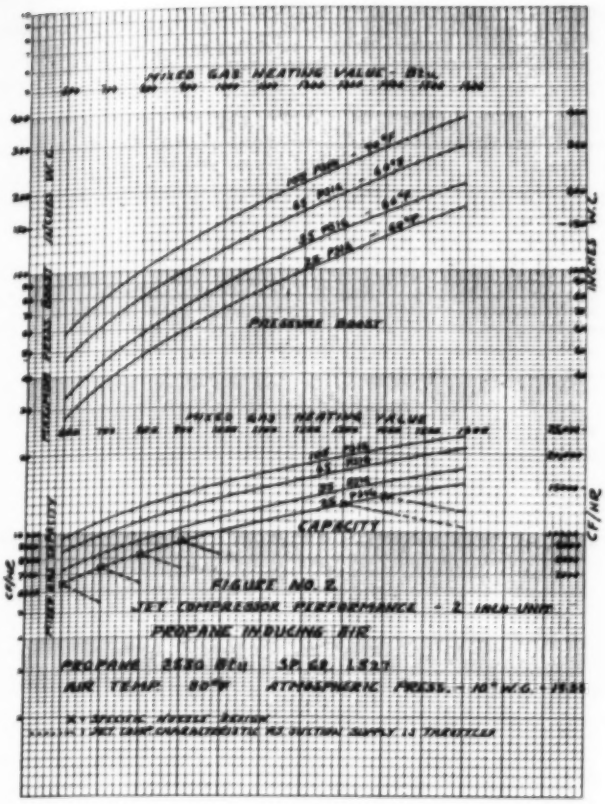


Fig. 2. Design performance data for propane-air jet compressors.

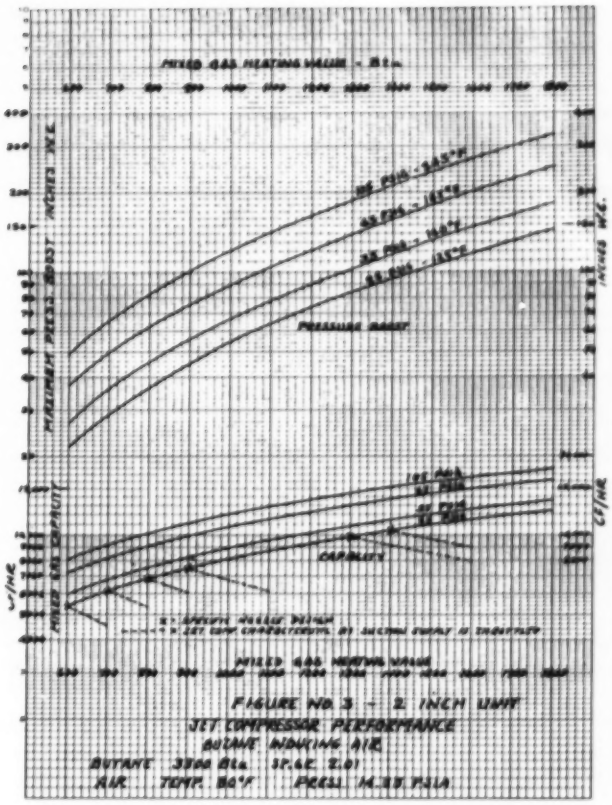


Fig. 3. Design performance data for butane-air jet compressors.

velocity flow. In other words, a conversion of the potential energy of the gas pressure into kinetic energy of velocity takes place. Part of the energy thus available is transferred to a gas which is drawn through the suction piece, Item 5, the check valve, Items 6, 7, 8, and 17, into the suction chamber of the body, Item 1, by transferring the momentum of the nozzle gas flow to the combined nozzle and induced gas flow in the straight mixing tube section of the tail.

The mixture then enters the diffuser section where the velocity is reduced with a corresponding increase in static pressure at the end of the tail of the jet compressor. Thus, as the mixture velocity decreases, the kinetic energy is converted into potential energy.

With correct design, 100% of the momentum of the nozzle flow can be transferred to the mixture flow in the straight mixing tube section. The efficiency in conversion of the energy in the flowing mixture in the straight section of the tail into potential energy or pressure, at the end of the diffuser section, is also quite high, approaching 95% in a well designed and constructed gas jet compressor.

For the purpose of understanding jet compressor performance and application, it is useful to consider the device as a constant-rate pump, which should be used only under conditions that approximate the design specifications. The rate of nozzle flow is determined by the nozzle orifice size and the gas conditions (pressure, temperature, density). This, of course, determines the energy available to pump the induced gas. With the quantity of energy fixed, the maximum amount of gas that can be pumped to a certain final pressure will be determined by size of the mixing section, suction pressure, temperature, density, and efficiency of transfer of momentum. The induced gas flow can be reduced from the maximum by throttling the induced gas flow, or the mixed gas flow. This will change the proportion of nozzle gas to induced gas in the final mixture. Appreciable changes in nozzle supply pressure will also radically affect performance. A change in pressure not only changes the amount of energy available, but also may affect the efficiency in the transfer of momentum. Thus, an appreciable increase in nozzle pressure, although it represents an increase in available energy, may not actually result in an increase in the amount of gas that can be induced. Consequently, a gas jet compressor does not have characteristics similar to those of a centrifugal compressor, e.g., the ability to deliver a variable volume to essentially a constant pressure. This limitation introduces a problem in selecting jet compressors for an application in which rate of gas make must equal demand.

From the foregoing, it should be apparent that the design of jet compressors requires complete data on the nozzle gas, induced gas, and desired mixed gas conditions. In most gas jet compressor applications, it is desired to make a specified quantity of mixed gas at a certain heating value against some specified pressure condition. In order to determine dimensions of the unit and predict performance, the following data are essential:

Nozzle gas and induced gas —

1. Maximum and minimum heating value.
2. Maximum and minimum temperature.
3. Maximum and minimum density or specific gravity.
4. Pressure at which nozzle gas can be delivered to jet compressor.
5. Pressure at which induced gas will be available. (The minimum pressure, if variations are expected.)

Mixed gas —

1. Desired heating value.
2. Capacity required.
3. Maximum pressure against which the jet compressor will discharge.

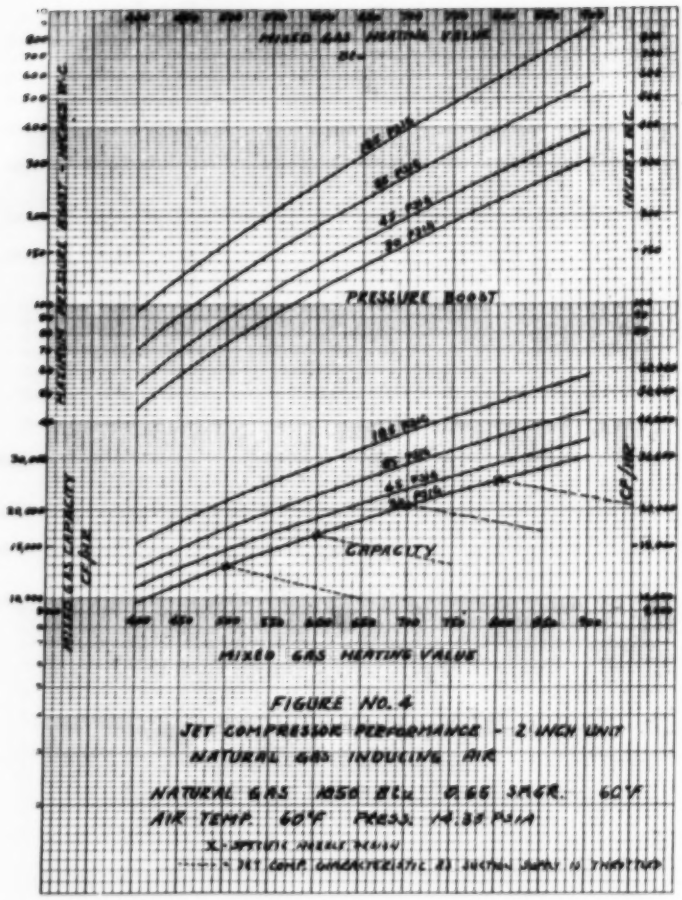


Fig. 4. Design performance data for natural gas-air jet compressors.

The actual design will then have to be based on the following data:

1. Maximum nozzle gas heating value. (On the assumption that the induced gas has the lower heating value, this will require the maximum flow of induced gas.)

2. Minimum nozzle gas temperature and density. (This gives minimum energy for given nozzle pressure.)

3. Maximum induced gas temperature, density, and heating value. (This requires the maximum energy for pumping the induced gas.)

Although the design calculations may show that it is possible to build a jet compressor to satisfy the desired mixed gas conditions, a number of structural points require consideration in order to develop the maximum discharge pressure.

The fundamental design ratio for given conditions of operation is the ratio of nozzle orifice diameters to diameter of the straight section of the tail piece. Thus these dimensions must be maintained quite accurately in the actual jet compressor. Alignment of parts is also important. For proper energy conversion and transfer of momentum, it is essential that the axis of the nozzle be directly in line with, and parallel to, the axis of the tail.

For maximum discharge pressure, the design of the diverging section of the nozzle is important. The opening at the end of the nozzle in relation to the nozzle orifice is a function of the kind of gas and the absolute nozzle supply pressure.

The location of the nozzle in respect to the tail is important, particularly if there is any tendency for the nozzle to obstruct the flow of the induced gas into the tail. The length of the tail section, both venturi or throat, and the diverging section must not be too short to prevent proper conversion of velocity head to static head at the end of the jet compressor.

Certain auxiliary devices also have an important bearing on jet compressor performance. Since the energy delivered to the jet compressor is obtained from the nozzle gas, it is essential that this gas be delivered at the design pressure. This requires a pressure regulator that will hold the gas pressure at a fixed value as changes occur. Valves in the nozzle supply, induced gas supply, and mixed gas delivery must be sized to prevent undesirable pressure losses that might interfere with proper operation. Restrictions in the induced gas line require that this gas be pumped through a larger pressure interval to reach a given mixed gas pressure. Obviously, this requires more energy. Similarly, restrictions in the other lines will produce undesirable effects.

Since the application of the jet compressor necessarily results in the mixed gas being at a higher pressure than the induced gas, a check valve or other automatic closing means is required in the suction line to prevent back flow when the nozzle gas flow is shut off. In *Fig. 1* a check valve has been included as an integral part of the jet compressor. The design of this part involves considerations that can also be used as a guide in selecting separate check valves for applications in which they are not a part of the jet compressor. A tabulation of the most important items follows:

1. The check valve must close leak tight. This requirement will assume greater importance when considering gas-mixing controls with a multiple number of jet compressors, some of which will be shut down while others are operating.

2. The pressure drop at maximum induced gas flow should be as small as possible. This means a light, freely moving disc in the check valve and sufficient travel to prevent restricting the flow of induced gas.

3. Although requirement 2 might tend to result in a device that is not strong mechanically, two operating requirements necessitate considerable mechanical strength. In those cases where considerable energy can be transferred to the induced gas, i.e., where the jet compressor can operate against a fairly high back pressure, the opening of the check valve when the jet is turned on will take place under a condition where the disc is accelerated very rapidly. If the stroke of the disc is limited by stops, etc., considerable forces will be developed when the disc stops. The second operating condition that requires a strong disc in the check valve is the possibility of turning on the nozzle gas with the discharge of the unit closed. In this case the pressure drop across the disc will quickly build up to a value equal to the nozzle gas pressure.

4. Free movement and tight seating require good hinge design and proper disc suport.

One other point on the design of gas jet compressors should be considered. Since the equipment is used as a pump and since the maximum discharge pressure available for a given nozzle pres-

sure is not very high, the unit must usually be designed to produce the maximum discharge pressure possible for the conditions given. Since this requirement is almost universal, we shall consider performance data only for jet compressors designed on this basis.

Figs. 2, 3 and *4* give typical design performance data for propane-air, butane-air and natural gas-air jet compressors. These figures represent optimum values that must be modified somewhat in actual application. Consideration of *Fig. 2* will serve to explain the data shown.

This figure shows mixed gas capacity in cubic feet per hour and maximum total pressure boost (pressure interval through which atmospheric air can be pumped) in inches w.c., plotted as a function of mixture heating value for certain nozzle pressure conditions. The curves are based on a jet compressor design in which the same body and suction chamber, tail section, and inlet piece are used. A new nozzle, however, would be required for each mixed gas heating value point and each nozzle pressure. For example, with 25-psig nozzle pressure, the propane-air capacity at 800 Btu mixture is 8300 cu ft per hour and the maximum pressure boost is 47 in. w.c. This will require a specific nozzle design. However, the curves show that the same jet compressor, but with a new nozzle, will produce 13,100 cu ft per hour of a 1350-Btu propane-air mixture at a maximum pressure boost of 125 in. w.c. with 25-psig nozzle pressure. Similarly, a new nozzle would be required for operation at the other nozzle pressure conditions shown.

TABLE 1. CAPACITY FACTORS

Size of Jet Compressor, Inches	Capacity Factor
3/8	.0312
1/2	.0625
3/4	.1250
1	.25
1 1/2	.50
2	1.0
3	2.0
4	4.0
6	8.0
8	16.0
12	32.0
16	64.0

Capacity data are for a 2-in. gas jet compressor. This size designation refers to the pipe size for the suction and mixed gas connections. The capacity factor for other sizes is given in *Table 1.*

The curves show that the capacity can be increased and maximum pressure boost increased by using the proper nozzle as the required mixture heating value is increased. This is the result of the fact that at higher mixture heating values, the percentage of nozzle gas increases so that the nozzle gas represents a considerably greater portion of the total mixed gas, making more energy available for pumping the air. Similarly, at a given mixed gas heating value condition, higher nozzle pressure makes more energy available. Efficient use of the energy requires a new nozzle for each condition.

Although the curve sheets do not show the operating characteristics of a given jet compressor under varying conditions, the following generalizations can be made:

1. The jet compressors have been designed so that an increase in nozzle supply pressure for a limited range will permit operation at a higher pressure boost for the same mixture heating value with an increase in capacity. It will also permit entrainment of more induced gas if the design maximum discharge pressure is not exceeded. This corresponds to a reduction in heating value of the mixture if the induced gas has the lower heating value.

2. Throttling on the suction side of the same jet compressor will reduce the flow of induced gas, resulting in reduced mixed gas capacity and higher mixture heating value. Typical mixed gas capacity changes under this condition of operation are shown on the curve sheets *(Figs. 2, 3,* and *4)* by the dotted lines extending to the right and down from the 25-psig capacity curve. Some increase in available pressure boost will take place even though the suction pressure is increased.

3. Increasing the temperature of the nozzle gas will make a small additional amount of energy available so that it will be possible to obtain a somewhat greater pressure boost for the design conditions.

4. An increase in induced gas temperature and density will require more energy to induce the same flow so that for a fixed mixed gas heating value the maximum pressure boost will be decreased.

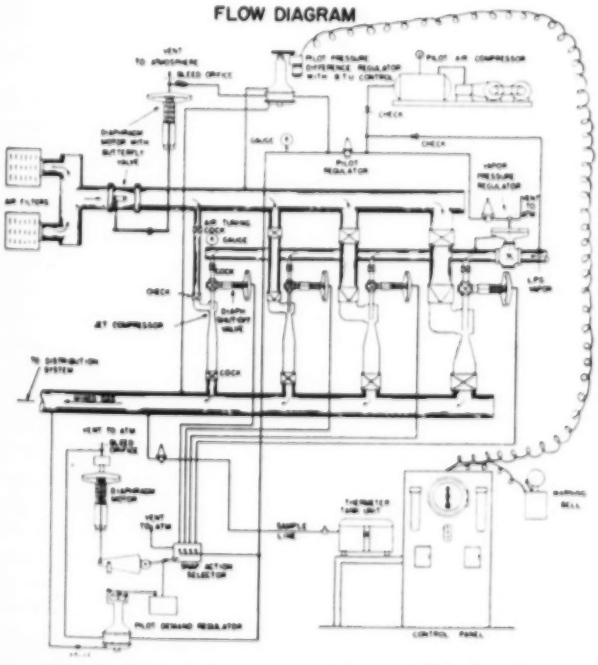


Fig. 5. Flow diagram of a 15-rate LPG-air plant.

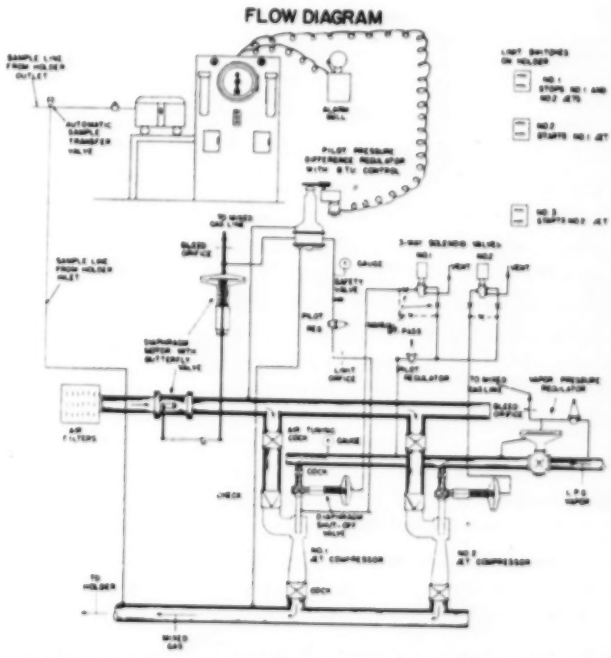


Fig. 6. Typical two-rate LPG-air plant for delivery to a low pressure gas holder.

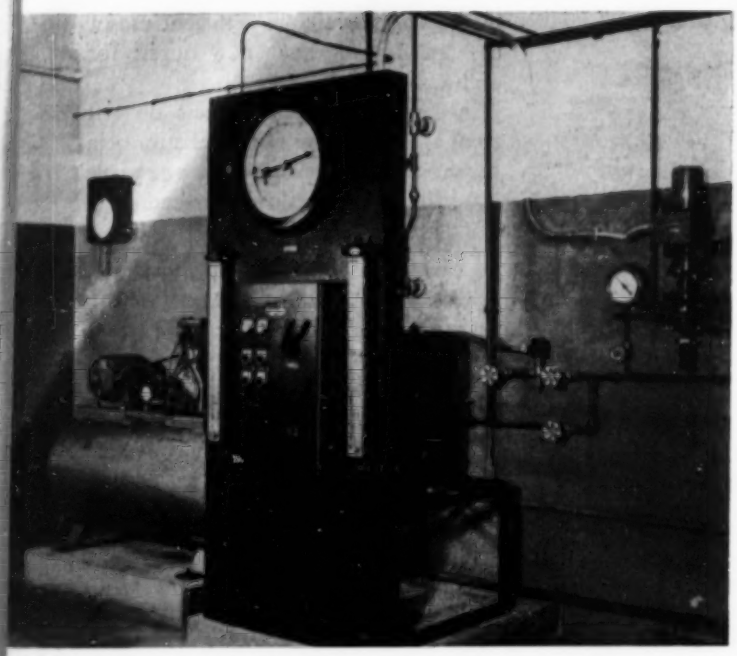


Fig. 7. A typical installation of a small 15-rate propane-air jet compressor installation, with the pilot air compressor at left.

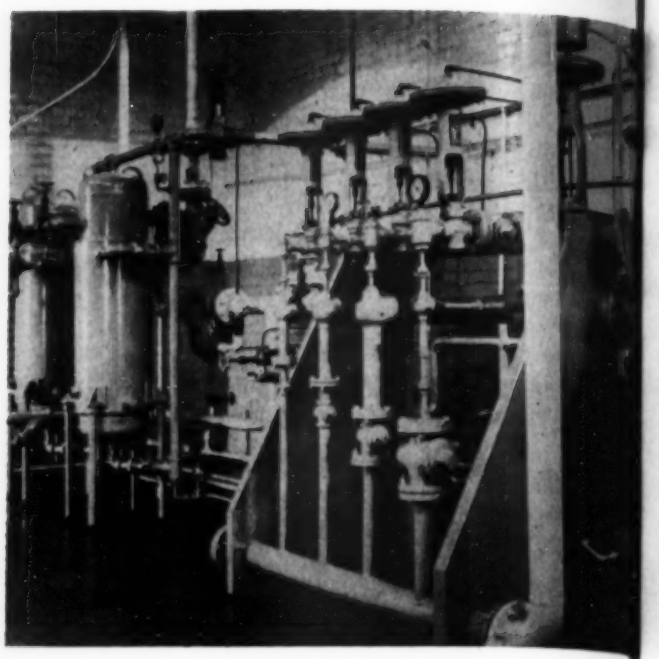


Fig. 8 shows the unit assembly of the four jet compressors and the associated diaphragm-operated shutoff valves.

5. Operation at a higher mixed gas heating value than the design value increases the proportion of nozzle gas and permits securing a higher maximum pressure boost.

6. An increase in back pressure on the jet compressor, particularly as this pressure approaches or exceeds the maximum pressure boost, will result in a decrease in the induced gas flow.

It should be obvious that the converse of each of the above statements would also be true.

The foregoing discussion of the design and performance of gas jet compressors indicates a number of important limitations that are inherent in the device and that make the application to gas mixing and pumping problems difficult. The use of liquefied petroleum gas-air mixtures for complete gas supply, standby, or peak shaving purposes, presents what seems to be an ideal application for gas jet compressors to pump the air required. However, in many instances the results are quite unsatisfactory because of limitations of the jet compressors themselves or the control systems used. The chief objections are:

1. Failure of the jet compressor to proportion air to gas when discharging against a variable pressure.

2. Trouble in securing the proper proportioning with a multiple jet compressor installation. Even in a recent middle western installation, this problem was only partially solved by using a so-called electronic totalizer on an auxiliary enrichment scheme to give approximate mixed gas heating value control.

3. Difficulty in securing any range of adjustment of the mixture heating value manually.

4. Difficulty in securing a means of automatic control of the mixture Btu. Where solutions of this problem have been attempted, compromise schemes, such as bypass enrichment with electronic totalizer, have been used.

5. Trouble providing gas-making capacity that could smoothly follow variable demands such as are encountered on a distribution system.

With these limitations in mind, a jet compressor gas mixing control system was devised about seven years ago as illustrated by *Fig. 5*. This typical flow diagram shows a 15-rate LPG-air plant for delivery direct to the gas distribution system. Consideration of this diagram will serve to explain the principles of operation and the features which overcome the objections outlined above.

1. The jet compressors are designed for maximum pressure boost for the specified mixture heating value.

2. Pressure difference control is applied to insure that the induced air is boosted through a fixed pressure interval for a given mixture heating value by the jet compressor for all conditions of discharge pressure requirements up to the design rating. This type of operation is secured through a pilot pressure difference regulator with Btu control, which positions a diaphragm motor operated butterfly valve in the air suction line to the compressors to hold a set pressure difference from the suction side of the jet compressors to the mixed gas discharge. Thus, as the mixed gas pressure decreases, the control throttles the air suction the same amount, holding constant the interval of pressure through which the air must be boosted. This will require a constant energy input for the same induced air flow. The constant energy supply can be maintained by holding a fixed pressure at the nozzle. In this way, the required proportioning characteristic could be maintained. In order to secure this suction pressure control, a small pressure drop is required on the control butterfly valve. Thus, the maximum discharge pressure obtainable is approximately 10 in. w.c. less than the maximum pressure boost given on *Figs. 2, 3,* and *4*.

3. By changing the pressure interval through which the air is boosted by increasing or decreasing the set point of the pilot pressure difference regulator, Btu control can be secured. It is then very simple to adapt the standard automatic Btu control schemes using a Thermeter or Calorimeter-Calorimixer combination, to the system. A motor-operated loading mechanism permits the automatic control. In actual operation, the heating value can be increased by increasing the pressure difference maintained by the regulator, which results in more throttling of the air suction so that for a given energy input, less air will be pumped. This feature gives direct control of the final mixture heating value without the use of auxiliary schemes such as a bypass enrichment line with control valve and an electronic totalizer.

4. In order to match gas-making capacity with distribution system demand, a combination of four jet compressors, each

with twice the capacity of the next smaller unit, a pilot-demand regulator and a diaphragm motor operating a snap-action selector are used to give 15 equal steps in gas-making rate. This gives gas-making capacity that will much more nearly match the system demand and, consequently, will result in much smoother operation of the equipment and much more uniform control of distribution pressure.

The pilot-demand regulator and 15-rate selector mechanism is designed to permit maintaining one of three types of system pressure characteristics. The equipment can be adjusted to hold an increasing mixed gas pressure with increasing demand. This insures much better service to customers during high demand, and reduces leakage losses since minimum pressure is maintained during minimum demand. The control can also be set to hold essentially a constant system pressure which would be required on low pressure systems without individual house regulators. A third characteristic can be secured that gives decreasing pressure with increasing demand, which is particularly suitable for peak shaving operations.

5. In order to secure the proper precision of nozzle pressure control, the system includes a pilot loading, pressure balanced type regulator insuring the required pressure over the range in flow required.

6. Control of the jet compressors in operation is obtained through diaphragm-operated shut-off valves, which are single seat, composition disc for leak tight shut-off. These valves open or close the nozzle supply line to the individual jet compressors, thus turning the units ON and OFF.

7. The jet compressors include an integral check-valve on the suction side to prevent back flow of the mixed gas when the unit is not operating. The check valves have composition discs for leak tight shut-off.

8. The control system insofar as gas making is concerned can be made to be independent of electric power.

9. A means of "tuning" the individual units is provided to compensate for small variations that may exist. This tuning is accomplished by throttling with check valve item 14, *Fig. 1*, or by throttling on a separate valve in each suction line.

In the system shown in *Fig. 5* the actual Btu controller is a Thermeter that not only provides the automatic Btu control feature but gives a continuous record and indication of the mixed gas heating value.

It should be noted that compressed air is used as the power medium to operate the pressure difference control on the jet compressors and the pilot-demand regulator with rate selector which determines the sequence of jet compressor operation. In case of compressed air failure for any reason, a connection is provided to use the LPG vapor as the pilot loading medium. The bleed from the various pilot devices is vented to atmosphere. In this type of control it is not practical to use the vapor as the loading medium and bleed into the mixed gas line because the equipment must be capable of going to zero rate of make. A bleed into the mixed gas line at that time would, of course, seriously affect the mixture heating value. Actual air requirement is about 50 to 60 cu ft per hour for this pilot loading.

Examination of the control system will show that gas making is independent of electric power. Although the pilot air compressor is shown as electric driven, on failure of power and subsequent decrease in pilot air pressure, the vapor loading will take over automatically. Gas making will continue in exactly the same way, with the control equipment functioning on the vapor loading just as it did with the air loading.

Electric power failure will, of course, stop the automatic Btu control and the calorimetric device, such as the Thermeter. However, this means merely a loss of indication and record of mixture Btu during power failure. The pilot pressure difference regulator will continue to control the jet compressors so that they will make the same heating value gas as exisited at the time the failure occurred. With a Thermeter being used, on restoration of power the instrument must be re-lighted. In the case of a Calorimixer, the instrument automatically resumes operation when power is restored. In addition, on the Calorimixer a battery-operated power failure alarm is provided. This feature can easily be added to the Thermeter control.

The pilot-demand regulator and rate-selector mechanism with the 15 possible rates of make normally provide the desired distribution pressure control so that additional capacity in the form of surge tanks or the like is not required. However, a relatively simple check of distribution system capacity in relation to plant gas-making capacity can be made to determine if additional capacity is required. In the case of a 15-rate plant operating to a low pressure system without individual house regulators, the system capacity in cubic feet should be such that a flow of 3⅓% of plant capacity will change system pressure by not more than 5% of the mean value in 20 seconds. For applications where system pressures are maintained at a higher value so that individual house regulators are used, the system capacity should be such that a flow of 3⅓% of plant capacity will change pressure by not more than 10% of the mean value in 20 seconds.

A wide variety of capacity combinations is available in the 15-rate type of equipment. The smallest plant producing a 600-Btu propane-air mixture has a capacity of 3000 cu ft per hour of mixed gas at a jet compressor nozzle pressure of 30 psig. The largest standard completely assembled 4-jet compressor unit has a capacity of approxi-

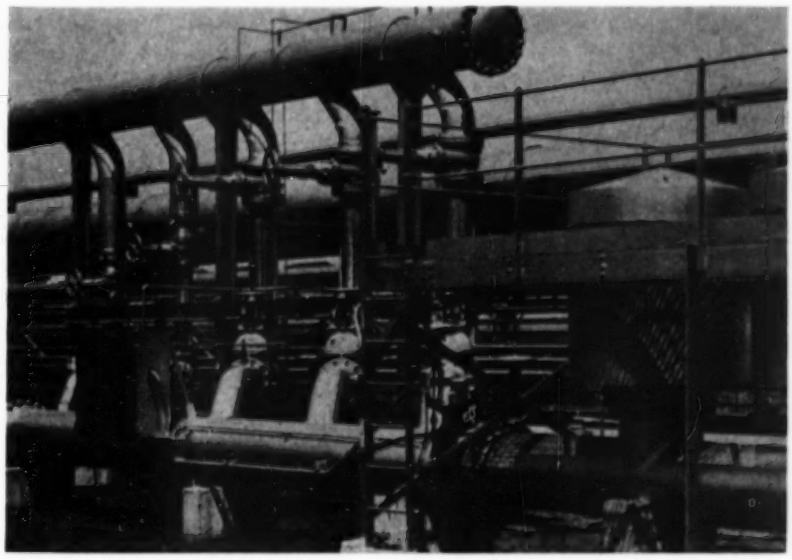


Fig. 9 shows a large natural gas-jet compressor installation.

mately 190 Mcf per hour of 1300-Btu propane-air with 30-psig nozzle pressure. Actually, considerably larger capacities can be obtained by using larger jet compressors. However, these systems would not be furnished with a unit assembly of 4 jet compressors, but with individual parts assembled in the field.

Fig. 6 shows a typical two-rate LPG-air plant for delivery to a low pressure gas holder. In this control system gas making is determined by holder position. Again, the system includes the pilot pressure difference regulator with Btu control to insure proper jet compressor performance and to permit automatic Btu control from a Thermeter or a Calorimixer-Calorimeter combination. It should be noted that the vapor is used as the pilot loading medium and that the bleed goes back into the mixed gas line.

Variations possible

A number of variations of this system are possible to meet special installation requirements. For example, by using two sizes of jet compressors, an additional holder switch and suitable electrical control, a three-rate system can be provided. It is also possible to replace the holder switches with push buttons giving an operator manual control of the gas making rate.

For peak load operation a manual 15-rate system has also been designed. In this type of control the selection of rate of make is manual, giving 15 equal steps. The rate selector itself has been designed to use compressed air as the power medium to start and stop the jet compressors, or a special manual drum selector switch can be substituted which uses electric power to energize solenoid valves controlling the diaphragm shut-off valves. The first type can, of course, be made independent of electric power.

Although the foregoing information has emphasized jet compressor applications to LPG-air gas mixing, a large number of control systems for natural gas-air mixing have also been furnished. The same control schemes have been used because the problems have been essentially similar. However, since these systems have been used primarily to produce modified gas, which is added to manufactured gas, the control of rate of make has been manual, and frequently a very wide range of capacity is required. The capacity range has been secured by using more jet compressors.

A typical installation of a small 15-rate propane-air jet compressor installation is shown in *Figs. 7* and *8*. In *Fig. 7* the pilot air compressor is shown at the left of the control panel. The Thermeter and electrical control are a part of the panel in the center. At the right of the illustration is the motor-operated pilot pressure difference regulator with Btu control motor. *Fig. 8* shows the unit assembly of the 4 jet compressors and the associated diaphragm-operated shut-off valves for turning the units "on" and "off." The 15-rate mechanism is in the box on the right end plate of the assembly. The diaphragm operator for the mechanism is the device on the top of the assembly with the cylindrical pot. The mixed gas pressure impulse line and the pilot demand regulator are on the bottom of the 15-rate selector box. Located on the right side of the picture is the diaphragm-operated butterfly valve in the air suction header to the jet compressors. This valve is positioned by the Btu adjuster shown in *Fig. 7*.

It should be noted that the right hand jet compressor is quite small in relation to the shut-off cock in the mixed gas discharge. This construction permits doubling the plant capacity by merely replacing the existing jet compressor with a unit twice the capacity of the one just to the left. The connections to the 15-rate mechanism are then changed to give the proper sequence of operation of the jet compressors. Capacity of the installation illustrated is 25,000 cf/hr of 1325-Btu propane-air with 40-psig propane on the nozzles.

Manual 15-rate plant

Fig. 9 shows a large natural gas-air jet compressor installation. This is a manual 15-rate plant for producing modified gas for addition to manufactured gas. Five jet compressors are used, one 6-in., one 8-in. and three 12-in. units. Capacity of 540 Btu mixed gas was 1.5 MMcf per hour with natural gas supplied to the jet compressor nozzles at 40 psig.

One other application of gas jet compressors has been proposed that represents some interesting possibilities in certain gas utility operations. In this application a 15-rate unit would be used to supply gas to an intermediate pressure system by using gas from high pressure storage to pump gas from low pressure storage. In one form, operation of the control system would be as follows:

Manufactured gas is made into a low pressure holder to serve a low pressure distribution system. Part of this gas is also pumped into high pressure storage from which it is used to supply an intermediate pressure system. Frequently the high pressure storage is not sufficient to supply the intermediate pressure system load for overnight operation. In this instance a low pressure compressor or centrifugal unit must be operated to pump gas from low pressure storage to the intermediate pressure system. This may require an attendant and additional personnel at night even though the total gas in storage would be more than sufficient.

Most economical use

By using the 15-rate jet compressor plant with pilot demand regulator and rate selector, the gas in high pressure storage can be used to pump gas from low pressure storage into the intermediate pressure system. This system then makes the most economical use of the high pressure gas and since it is completely automatic and independent of other sources of power, no operators would be required.

The same idea could be used to deliver natural gas into an intermediate pressure system from low pressure holders as long as high pressure natural gas is available. It would eliminate the requirement to operate other pumping equipment which would be necessary if it were desired to deliver gas from low pressure storage to an intermediate pressure system. This could represent a convenient form of peak load operation on natural gas that would not require the use of steam- or electric-driven compressors.

In conclusion, it should be remembered that the jet compressor design outlined and the control systems using these units that have been discussed, make possible the proper application of this type of pumping equipment to gas utility operation because:

1. The jet compressors are controlled to give the required characteristics.
2. The control schemes permit Btu control of the final mixture heating value which is essential in gas mixing.
3. The control of gas making rate gives the flexibility required and insures the maintenance of the desired system pressure conditions.

The Dallas Lightweight Aggregate Co. began production in 1953. At the left is the cooling stockpile of aggregate before crushing. Storage silo for finished aggregate is 80 ft high. In the background is the 700-ft conveyor, which carries the aggregate to bins of the Texcrete Co. where it is processed into building block of various sizes and designs.

Gas fuels the fast-growing lightweight aggregate industry in the Southwest

By BRUCE CUNNINGHAM

GAS is playing a major role in development of the lightweight aggregate industry in the Southwest by supplying essentials of low-cost fuel, ease of handling, cleanliness, dependability, availability and—of prime importance—controlled high temperatures for processing. Leaders of this fast-growing business point out that prices of other fuels would make profitable production of lightweight aggregate impossible in this section of the country.

Lightweight aggregate, a structural material made from clay or shale requiring intense heat in the processing procedure, is lowering costs and overall weight while raising the quality and strength of buildings—from skyscrapers to backyard garages.

GAS exclusive

The industry claims that concrete produced with lightweight aggregate is as strong as conventional concrete, yet 40% lighter, which means important savings in foundation and reinforcing steel costs in multiple-story buildings. Also, industry leaders point out, lightweight aggregate offers the highest insulating efficiency of any type of structural concrete.

Case in point is Hotels Statler Inc., of New York, which is writing a new chapter in the history of southwestern construction. The corporation's new Dallas hotel will be the first multiple-story flat slab cantilever-supported, reinforced lightweight concrete building erected in the region.

More than 16,500 cu yd of lightweight aggregate concrete will go into the 1001-room, $15 million ultra-modern Hotel Statler now under construction in Dallas on St. Paul between Commerce and Jackson streets, adjacent to headquarters buildings of the Lone Star Gas Co.

Partitions and back-up in the building will require approximately 130,000 lightweight concrete blocks. The savings in weight effected by these two lightweight building materials alone

will approximate 14,500 tons. The total does not include another substantial saving in dead weight, which is the result of a decrease in reinforcing metal brought about by use of the lightweight concrete.

Completion of the Statler hotel in Dallas is scheduled for August 1955. Excavation began on Oct. 1, 1953. Construction of the hotel above the ground level, where the bulk of the lightweight aggregate is being poured, is now in full swing, with an average of 150 cu yd of concrete being poured daily. This part of the construction started early in May.

Robert E. McKee, General Contractor Inc., of El Paso (his home office), Santa Fe, Los Angeles and Dallas—builder of the Statler—is mixing the lightweight aggregate concrete in his company's batching plant in Dallas' Trinity industrial district. The mixture, consisting of lightweight aggregate, cement and water, is transported to the job by Mr. McKee's fleet of ready-mix trucks.

"Haydite" aggregate

Lightweight aggregate for the concrete is coming from the kilns of the Dallas Lightweight Aggregate Co., a unit of Texas Industries. The company's product is called "Haydite," which is coined from Stephen J. Hayde, who patented the lightweight aggregate process in 1920.

Expansion of the lightweight aggregate industry in the Southwest began shortly after April 1946, when the Hayde patents had expired. At that time only one plant existed in this section of the country and it was in Kansas City, Mo. Since 1946, 13 additional plants have been placed in operation in the Southwest. They operate 37 kilns located as follows: 24 in Texas, two in Oklahoma, four in Louisiana, two in Kansas, one in Arkansas, and four in Missouri.

Daily capacity

Average daily capacity of each of the 37 kilns is estimated to be 140 cu yd of lightweight aggregate. Gas is the preferred fuel in this production primarily because of its effectiveness in maintaining kiln temperatures as hot as 2100° F. These kilns consume between 13 and 14 MMcf of gas daily and the fuel is supplied by six gas companies.

The Dallas Lightweight Aggregate Co. is typical of the industry in the Southwest, operating three rotary kilns. Two are 6 ft and one is 7 ft in diameter. All three are 75 ft in length and operate at two revolutions per minute. The kilns are rotated by variable speed drives stepped down from 1200 rpm to 2.0 rpm. The rotating force is applied through a bull pinion engaged with a girth gear on each kiln. Rotation of the kiln may be clockwise or counterclockwise, the direction being determined by convenience.

The kilns are in production on a round-the-clock basis seven days a week. They turn out some 125,000 cu yd of lightweight aggregate annually, requiring approximately 400 MMcf of gas in the process.

Companies adjoin

Thic company adjoins the Texcrete Co., also a part of the Texas Industries organization. Shale is mined from nearby pits, processed in gas-fired kilns, crushed into graded sizes and made into lightweight block or other structural units in one continuous operation at these combined plants. Officials believe it is the only operation of its kind in the country.

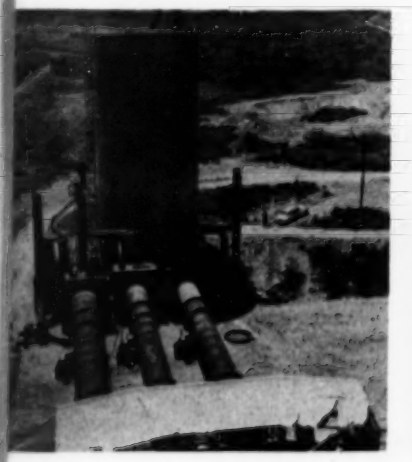
The shale is mined with a ¾-cu yd shovel, hauled by motor truck and dumped over a grizzly into a 24- by 42-in. crusher. Then it is passed to an elevator, which carries it into an 80-ft concrete storage silo. From the silo it moves by gravity first then is fed by variable speed conveyors into one of three rotary kilns.

Ten-inch pipe

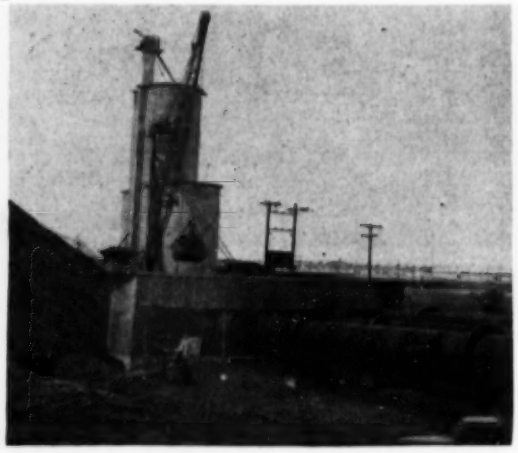
The shale from which the lightweight aggregate is made is fed through a 10-in. pipe into the upper end of a kiln, which is housed in a dust chamber surmounted by a gas, smoke and dust stack. The kilns are fired by gas at the lower end. Since the firing nozzle extends into a kiln, the hottest part of the kiln is several feet upward from the lower end. The kilns are lined with fire brick.

The gas flame at the hottest point reaches a temperature of approximately

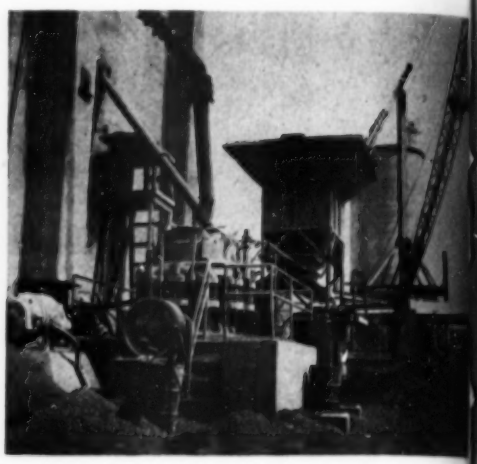
From raw shale . . . .



The 80-ft silo stores raw shale. The rotary kilns are fired at lower right.



Shorthead cone crusher installation. In the background is a feed hopper, hoist, and a 1600-cu yd shale storage silo.



At left is the cooling stockpile of aggregate before crushing. Storage silo for finished aggregate is 80 ft high.

3400° F and walls of the kiln at this hottest point attain a temperature of some 2100° F. The shale is slowly heated in its downward journey through the kiln. A stage of incipient fusion (just short of the melting point) is reached in the region of the 3400° gas flame, which is controlled automatically to prevent the materials from forming into a molten mass. This high temperature expands the gas formed within the shale and causes it to swell or bloat.

Clinker formed

The expanded shale is cooled somewhat, but still is red hot after dropping into a pit through a firing hood at the lower end of the kiln. The material has now formed into a hard, strong vitreous clinker with millions of non-connecting, dead-air cells. The clinker is moved from stockpiles by clamshell to a bin over a series of crushers. The feed hopper to the crushers has a capacity of 22 cu yd. It was designed by the company's own engineers.

Clinker is fed to the crushers by a vibrating feeder. It passes over a grizzly with a 1½-in. bar spacing. Material passing through the grating goes to a 4-ft shorthead cone crusher. Oversize clinker goes to an 18- by 30-in. jaw crusher.

The crushed clinker, now lightweight aggregate, is taken by bucket elevator to a screen room built over the top of the 80-ft concrete storage silo, the center silo in a battery of three, with a capacity of 1000 cu yd. In the screen room the aggregate passes over two double-deck electric vibrating screens, which separate it into ¾-in. sizes for structural concrete, ⅜ in. to a size retained on a No. 4 mesh and from that size down to dust.

Any desired aggregate blend or size can be moved on the 20-in. conveyor belt from either of the three silos. The belt, 700 ft long, has three delivery points. It can deliver the aggregate to waiting motor trucks and railroad cars for transporting to structural concrete plants or building contractors, or to the 77-ft aggregate elevator at the Texcrete Co.'s plant adjoining. Here the lightweight aggregate is mixed with cement and water and shaped into building block of various sizes and design.

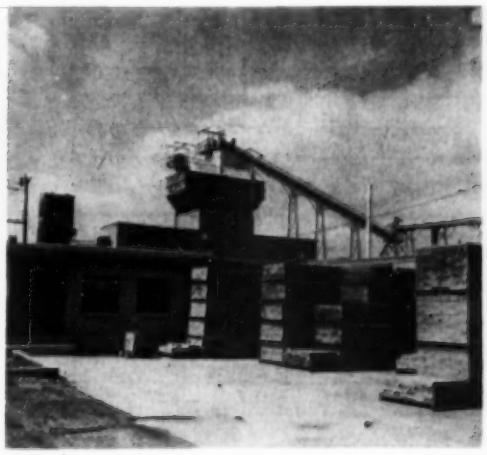
There is a 50-cu ft mixer over each block machine. In line with the two block machines is a super-lintelator, which casts lintels in various lengths from 3 to 10 ft. A traveling weigh batcher serves the two 50-cu ft mixers and a 19-cu ft mixer over the lintelator.

Steam-curing kiln

After the block is formed, it is conveyed in quantity to one of 12 steam curing kilns. Each kiln, 14 by 40 ft long, is insulated, incidentally, with the finished material that it is curing—Texcrete building block. The curing process requires moisture and heat. Both are provided by steam, which is termed the ideal medium for this process.

. . . . to finished concrete block

This 700-ft conveyor belt carries aggregate from the aggregate company to bins of the Texcrete Co. Note finished block in the storage



After arriving at Texcrete company, lightweight aggregate is mixed and shaped by special molding machines into building block.

The finished product at the Texcrete plant: Tex-Tile block with a glossy tile finish.

The finished block undergoes an intricate curing process in special highly insulated rooms where gas-generated steam is the curing agent. This practice is only one of the quality controls rigidly adhered to in the Texcrete plant.

Four components

The Texcrete aggregate bin has four compartments, one holding 400 bbl of cement and three with capacity for 60 cu yd of aggregate. The production room of the Texcrete plant is equipped with two front-feed, two-stop block casting machines. They have a combined capacity of 14,000 block in an eight-hour shift. The 14,000 block, each measuring 8 by 8 by 16 in., are equivalent to the surface covered by 90,000 face brick.

Low-pressure steam is supplied by a 125-hp gas boiler consuming approximately 12 MMcf of gas annually. Steam enters the curing kilns through special pipes at the bottom of each wall, after traveling through metal ducts from the gas boiler. Within three hours the steam has raised the temperature of the curing kilns to 170° F. The block undergoes this maximum temperature for one hour, then the steam is shut off and the block is left to "soak" for eight hours during which the temperature drops from 170° to between 120° and 125°.

After the steam curing process, the block is removed to the storage yard for air curing for at least 28 days. Now it is ready for market. This includes builders of homes, schools, churches and commercial structures by the hundreds of thousands throughout the Southwest.

Installing an odorizer

A discussion from the operating man's viewpoint of costs, efficiencies, and in-service problems of odorizing facilities, based on a system's experience.

By GEORGE G. DORMER
Manufacturers Light & Heat Co., Pittsburgh

1. Design and selection of odorant and equipment

THE Pittsburgh Group companies of the Columbia Gas System have made tests to determine the odor level of the gas distributed in their market areas.

The series of tests showed that not only the Southwest gas, but also gas from our underground storage fields and certain locally produced gas, when diluted with air to 20% of the lower explosive limit, did not have sufficient odor to attract attention and thereby act as a warning of gas leakage.* The end result was the decision to install a number of odorizing units.

Odor level tests were made with a device called an "Odicator," which consists of a small electric air blower operated from an electrical connection on a gas stove. This air blower discharges into an opening where the customer is asked to smell the air delivered by the blower. The instrument also has a gas connection and a tubing which can be slipped over a stove top-burner spud, thus supplying gas to the instrument. The amount of gas fed into the air stream is gradually increased until the customer faintly detects the odor of gas. At this point the button is pressed, and a built-in explosimeter dial is read in per cent of the lower explosive limit. The odor level is considered satisfactory

*During the past several years it has been necessary for the Columbia Gas System to purchase increasingly large quantities of natural gas from Southwest sources. Many of the gas companies in the Southwest have found it necessary to supplement the odor of natural gas so that gas leakage will be more readily detectable.

_____
Company

GAS ODOR LEVEL TEST

District _____ Date _____ AM PM 19

Service Area _____ Test Conducted By _____

Test Location: _____
Number Street City State

Odor Level at 0% Lower Explosive Limit

Odor Intensity	Observer 1	2	3	4	5	6	7	8	9	10	Total
0											
1											
2											
3											

Odor Level at 20% Lower Explosive Limit

Odor Intensity	Observer 1	2	3	4	5	6	7	8	9	10	Total
0											
1											
2											
3											

Odor Level at 40% Lower Explosive Limit

Odor Intensity	Observer 1	2	3	4	5	6	7	8	9	10	Total
0											
1											
2											
3											

Conclusion:

Odor Level:
Low
Satisfactory
High

Fig. 1. Odicator test form (above) and instructions (below).

Operating Instructions:

1. Place the odicator in operation with the gas supply shut off. Ask each observer to smell the mixture being blown out of the odicator and mark on a slip of paper provided for the purpose, his best judgment as to whether or not he can identify the odor of gas. Explain that the odicator may have a characteristic smell of its own, but that should not be confused with the odor of gas. Ask each observer to classify the odor in accordance with the following scale:

   0. No odor of gas.
   1. Faint odor of gas.
   2. Readily detectable odor of gas strong enough to arrest your attention and act as a warning of gas leakage.
   3. Excessive odor of gas (more than you feel is necessary to act as a warning of gas leakage).

2. Repeat this procedure with the mixture set at 20% and 40% of the lower explosive limit.

if the presence of gas is detected before the air-gas mixture reaches 20% of the lower eplosive limit (1% natural gas in air).

The odicator has been subject to considerable criticism because of its lack of sensitivity; but compared with the plus and minus readings caused by variations in the sensitivity of the human nose, the lack of sensitivity in the odicator instrument becomes less important. It is desirable to test five or more persons in making an odicator test in order to get a representative sampling. This test can easily be made at the average kitchen stove. An odicator test form is shown in *Fig. 1*.

The observer is asked to smell the mixture being blown out of the odicator at three odor levels; 0%, 20%, and 40% of the lower explosive limit. From these tests, it can be determined whether the odor level is low, satisfactory, or high. Operating instructions are on the back side of the report form.

Odorizer locations

It was decided to install odorizer units at each major gas purchase connection. Gas measurement was available at gas purchase connections, so that it was possible to obtain hourly or daily gas volume without the installation of additional measuring equipment.

A majority of our odorizers are installed in compressor station yards where manpower is available to check the odorizers and fill the odorant storage tanks. In some cases, the odorizer is on the discharge line from the compressor station. No trouble has been experienced from pulsation problems. In other cases, the gas purchase connection was located several miles from the compressor station, but the total volume of gas traveled to the compressor station where the odorizer was installed. At other sites, our odorizers are located several miles from the nearest compressor station or other headquarters and receive attention only once each week. Experience has shown that daily attention is not necessary.

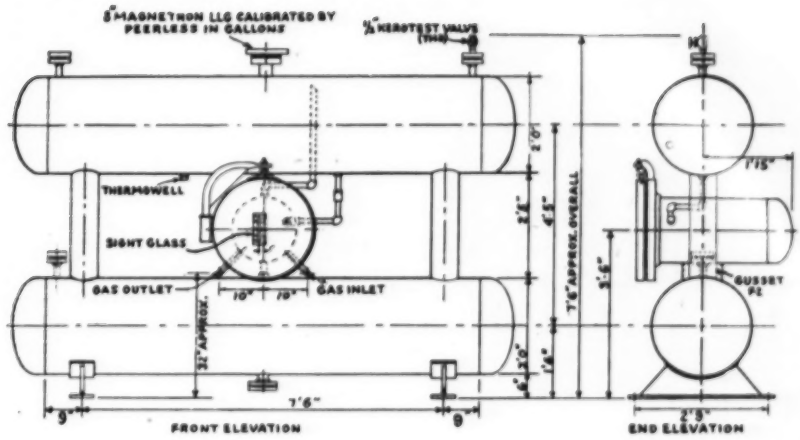
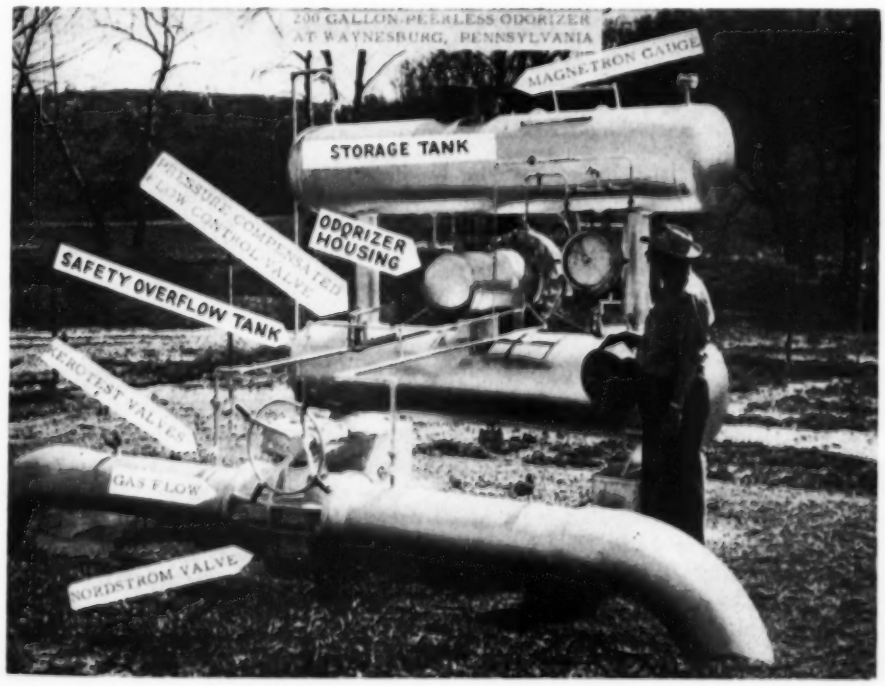


Fig. 2. The third odorizer, Type MPX, which was built to Pittsburgh Group specifications by Peerless Manufacturing Co.

Type of odorizer

During the past 10 years, many types of odorizers have been tested by one of our affiliated companies, the Binghamton Gas Works. These include drip, bypass, bubbler, pump, and Peerless odorizers. Based upon this experience, the Pittsburgh Group companies have standardized on Peerless odorizers because:

1. They accurately proportion the odorant in accordance with the gas flow.
2. They require very little maintenance.
3. They contain an odorant pump which is installed in a pressurized housing from which the odor cannot escape.



Overall view of an odorizer installation.

Peerless odorizer, Type M

The old style Peerless odorizer, Type M, has been in use for a great many years. The average installation consists of a storage tank with a gauge glass (which may break), a stuffing box (which may leak) at each end of the gauge glass, valves with stuffing boxes (which may leak), screwed fittings (which may leak), the odorizer pump in pressurized housing (which is heavy and difficult to remove), a gate valve with a stuffing box (which may leak), an orifice (which is difficult to adjust), a pressure compensating valve (which did not compensate very well), and a building (which is not necessary). This odorizer can still be purchased, but it has been largely supplanted by a newer model, the Peerless odorizer, Type MP-1.

Peerless odorizer, Type MP-1

The Peerless odorizer, Type MP-1, incorporates the same principle of odorant injection as the Peerless Type M with the following revisions in design:

1. The odorant storage tank has been changed from a vertical tank to a horizontal tank. (Eighty-five gallon capacity is the standard size.)

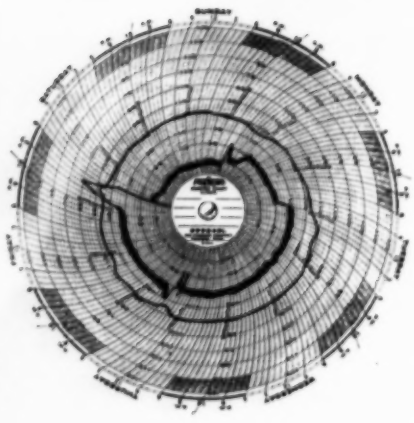


Fig. 3. The differential gauge chart, which is changed once each week. Below is a reproduction of the information on the back of the gauge chart.

The Manufactures Light & Heat Company
Porters Falls Odorizer

Chart on 8:00 A.M. ~~P.M.~~ 5-1 1954		Chart off 8:00 A.M. ~~P.M.~~ 5-8 1954	
Revolution Counter		Magnetron Gauge	
Final Reading	37,136	Final Reading	44.3 %
Initial Reading	26,612	Initial Reading	39.4 %
Difference	10,524	Difference	4.9 %
Factor	.00097	Factor	5
Odorant Consumed	10.2 Gal.	Odorant Consumed	9.8 Gal.
Odorant Consumed	71.8 Lb	Odorant Consumed	68.6 Lb.
Gas Delivered	149,000 Mcf	Gas Delivered	149,000 Mcf
Actual Rate	0.48 lb/1000 Mcf	Actual Rate	0.46 lb/1000 Mcf
Desired Rate	0.50 lb/1000 Mcf	Desired Rate	0.50 lb/1000 Mcf
Initial Readings By	M. J. Oliver	Calculations By	L. L. Lusky
Final Readings By	M. J. Oliver	Checked By	A. Perfetta

2. A Magnetron gauge has replaced the old gauge glass, thus eliminating two valves and a gauge glass.

3. The odorizer housing unit has been placed in a horizontal position so that it is no longer necessary to remove a heavy odorizer dome in order to work on the internal mechanism.

4. A daily fill tank has been added to calibrate and to provide measurable daily readings of odorant consumption. This has added three valves, one gauge glass, and two stuffing boxes. The copper tubing used to pipe the daily fill tank is subject to leakage.

5. A safety overflow tank was provided, equal in size to the storage tank, so that if the float valve in the odorizer mechanism sticks in an open position, the contents of the storage tank will drain into the safety overflow tank instead of into the pipeline.

Peerless odorizer, Type MPX

The Peerless odorizer, Type MP, did not meet the requirements of the Pittsburgh Group companies, and arrangements were made with the Peerless Manufacturing Co. to build odorizers to our specifications. The result was a third odorizer, Type MPX *(Fig. 2)*. This odorizer incorporates the same principle of odorant injection as Type MP-1, with the following revisions in design:

1. Two odorizers were designed; one was constructed of 16-in. pipe having 100-gal. capacity, and the other was constructed of 24-in. pipe having 200-gal. capacity. This has the advantage of making the Magnetron reading (in per cent) readily convertible to gallons by using a multiplying factor of *1* in the case of the 100-gal. tank and *2* in the case of the 200-gal. tank. The storage tank was provided with flanged connections instead of screwed connections.

2. The Magnetron gauge was increased in size from 6 in. to 8 in. and was moved from the side of the tank, where the Magnetron flange gasket was exposed to liquid, to the top of the tank where the Magnetron flange gasket would be exposed to vapor. (This might be important if the flange gasket were to develop a leak.)

3. A safety overflow tank was provided, equal in size to the storage tank. Flanged connections were specified on the safety overflow tank. Odorizer feet were so spaced that either the 100-gal. or the 200-gal. odorizer could be used on the same foundation.

4. A high pressure sight glass was placed in the flange of the odorizer housing so that the internal mechanism could be inspected while in operation.

5. A revolution counter was added to the odorant pump in such a manner that it could be seen through the sight glass, thus making it possible for us to obtain hourly readings or daily readings after the pump has been calibrated in pounds of odorant per revolution.

6. Kerotest packless diaphragm valves, Model R42U04P, have replaced ordinary valves with stuffing boxes. These valves have a stainless steel diaphragm in place of a stuffing box, thus eliminating all stuffing box leakage. The valves can be purchased in lots of 100 through the Kerotest Manufacturing Co. in Pittsburgh or in quantities of one or more through the Kerr Engineered Sales Co., Pittsburgh. The one valve on the odorant liquid line was placed inside the pressurized housing.

Restriction in the gas main

The Peerless odorizer requires that a restriction be placed in the gas main so that the pressure drop across this restriction can be used to operate the odorizer meter. This restriction can be an orifice plate or a valve of such size that the maximum differential across the valve will be 100-in. water column under conditions of maximum flow. Under all other conditions, the differential across the restriction will be less than 100-in. water column, but should never drop below 0.5-in. water column. At this differential the odorant injection rate will be about 5% below the design rate.

Sometimes it is necessary to change the area of the restriction for summer and winter flows. At least over a period of years, operating conditions do change. It is desirable to be able to make small adjustments in the mainline ori-

COMPANY

ODORIZER

Odorant Report for Month of _____ 19 ____

Date	Requisition	Purchase Order	Per cent	Gallons	Pounds	Cost
Tank Reading First of Month						
Added to Tank During Month						
Total Added						
Total to Account For						
Tank Reading on End of Month						
Odorant Consumed						

Storage Tank Measurement

	Odorized MMCF	Odorant Consumed Gallons	Odorant Consumed Pounds	Odorant LBS/MMCF	Remarks
January					
February					
March					
April					
May					
June					
July					
August					
September					
October					
November					
December					

Remarks:

Fig. 4 (above). The two-part monthly odorant report.

Fig. 5. (right) is a second monthly report of the total "odor of gas" complaints received.

_____ Company

MONTHLY REPORT OF SERVICE ORDERS

District _____ Month _____ 19___

Service Area _____ Compiled by _____

Number of Customers _____

Nature of Service Order	Service Orders Received	Service Orders Investigated
Leak on Transmission Line		
Leak on Distribution Line		
Leak on Service Line, Main to Curb		
Leak on Service Line, Curb to Meter		
Leak at Meter or Connections		
Leak at Service Regulator or Connections		
Leak on House Lines		
Leak at Appliances or Connections		
Miscellaneous Leakage		
No Leakage Found		
TOTAL "ODOR OF GAS" SERVICE ORDERS.....		
All Other Service Orders		
TOTAL OF ALL SERVICE ORDERS.....		
TOTAL "ODOR OF GAS" SERVICE ORDERS PER 1000 CUSTOMERS/WEEK.....		
TOTAL OF ALL SERVICE ORDERS PER 1000 CUSTOMERS/WEEK.....		

Remarks:

fice without resorting to an expensive bypass arrangement or without shutting the line off to remove an orifice plate. By experience, we have found it desirable to use a Nordstrom valve as a mainline orifice. A valve provides an infinite number of orifice sizes merely by the adjusting of the handwheel on the valve. In many cases, an existing valve can be used. However, it is not recommended that a valve be used that is also used for other operating purposes, other than for the infrequent shutting off of a line for repairs. The so that the differential setting on the valve used to produce an odorizer differential should be locked in a position valve cannot be accidentally changed, thereby changing the odorization rate.

The differential taps, upstream and downstream from the valve, should be located as close as possible to the valve so that the least amount of valve cramping will be necessary to produce the desired differential. Orifice flanges can be used, but are not necessary. Extra heavy couplings can be welded to the pipeline and then drilled through, just as if pipe taps were being installed for orifice measurement. Do not install the taps a great distance upstream and downstream from the orifice.

Selection of odorant

Captan was chosen as the odorant to be used because of previous successful experience with this odorant by affiliated companies. About a year ago, we changed from regular Captan to BP Captan because the latter is a constant boiling product which will completely evaporate. With this odorant, a gas leak will not continue to smell long after the leak has been fixed.

Approximately 0.5 lb of BP Captan per million cubic feet of natural gas will produce four leak complaints per thousand customers per week.

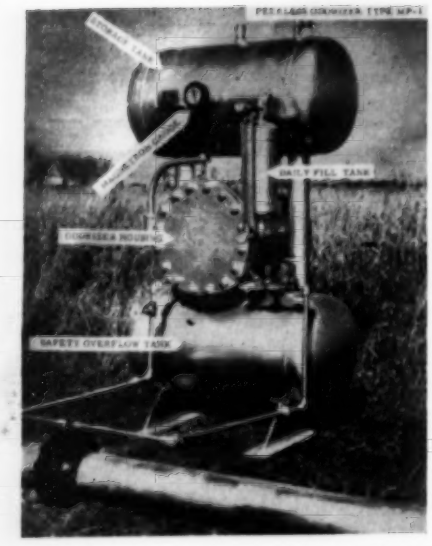
Experience has shown that this odor can be transmitted over distances in excess of 100 miles without noticeable loss of odor intensity.

Selection of odorant storage tank

Odorant can be purchased and shipped in 1-lb cans, 5-gal. cans, 15-gal. drums, 50-gal. drums, 3000-gal. tank trucks, or 6000-gal. railroad cars. The size of the odorant storage tank is determined by how often you want to fill the tank. Storage tanks of 100-gal. capacity were installed at locations having an average daily load of less than 20 MMcf per day. The odorant is purchased in 50-gal. drums, the initial loading being one drum. Therafter, when the level drops to 25%, the contents of one drum is added, thus increasing the storage tank to 75% full. If the gas rate is 20 MMcf per day and the odorant rate is ½ lb per million, the storage tank will require filling once each month.

Storage tanks of 200-gal. capacity were installed at locations having an

Mr. Dormer is a graduate of the University of Wisconsin having Bachelor of Science and Master of Science degrees in Chemical Engineering. For the past 11 years he has been employed by various operating companies in the Columbia Gas System. He has worked successively as gas plant superintendent, assistant division superintendent and assistant chief engineer for the Manufacturers Light & Heat Co. and other companies in the Pittsburgh group.



Peerless Odorizer Type MP-1, which has largely replaced the Type M, has several design revisions and has a horizontal odorant storage tank instead of a vertical one.

average daily load in excess of 20 MMcf per day. The odorant is purchased in 50-gal. drums, the initial loading being three drums. Thereafter, when the level drops to 25%, the contents of two drums is added, thus increasing the level in the storage tank to 75% full. This procedure prevents overfilling the storage tank, eliminates the handling of partially filled drums, and eliminates the necessity for filling an odorizer on an extremely cold or nasty day.

It is not desirable to select too large an odorant storage tank because some odorants may polymerize to form gums or may lose their odor intensity after standing for too long a period of time. To the best of our knowledge, we have not experienced this difficulty with Captan. Another reason for not selecting an excessively large odorant storage tank is that if the tank is allowed to "float on the line," it will breathe as the pressure changes, thus resulting in over and under odorization. We experienced this difficulty with several of our bypass odorizers, and the Titrilog was very useful in tracing down our trouble and showing us exactly what was happening.

Daily fill tank

The accuracy with which 1 gal. of odorant can be measured decreases as the capacity of the odorant storage tank increases.

Many companies desire to have a daily fill tank in order to keep a daily record of the amount of odorant consumed. The daily fill tank adds two valves to the odorizer, together with a gauge glass with two stuffing boxes and shutoff valves, thus increasing the possibility of leakage from the odorizer.

Our company has eliminated the daily fill tank by installing a revolution counter, which can be read through the sight window on the odorizer. The odorizer pump is then calibrated in terms of revolutions per gallon of odorant. This method has proved very satisfactory during the past year, not only for daily readings, but also for hourly test readings, which are sometimes required. The results check very closely with the monthly odorant storage tank readings.

Periodic reports

Where the odorizers are located at compressor stations, a daily record is kept of the gas flow and the odorant consumed based on revolution counter readings. A calculation is made to determine the rate of odorization.

Once each week the differential gauge chart *(Fig. 3)* is changed. On the back of the chart a record is made of the storage tank readings and the revolution counter readings at the beginning and end of the week. The gas flow is also recorded. This information makes it possible to calculate the rate of odorization and to check the revolution counter rate with the storage tank rate.

The monthly odorant record form *(Fig. 4)* is divided into two parts. The first part is an odorant stock report showing the tank reading at the beginning of the month, the amount of odorant added during the month, the total to account for, the tank reading at the end of the month, and the amount of odorant consumed by difference.

The second part of the report form shows the volume of gas odorized, the amount of odorant used in gallons and pounds (BP Captan weighs 6.35 lb per gal.), and the odorant added in pounds per million cubic feet. A cumulative record is kept for each month of the year.

A second monthly report form *(Fig. 5)* keeps a record of the total odor of gas complaints received during the month, broken down into the various classifications of leaks. This form also shows the total of all complaints received during the month.

Differential gauge

All of our odorizers are equipped with a 12-in. Foxboro orifice gauge, 0-100-in. water differential, Type H gauge piping, and a seven-day chart *(Fig. 3)*. These charts are mailed into the office, together with the revolution counter reading converted into gallons of odorant per week and the reading of the storage tank Magnetron gauge, at the beginning and end of the week. Inspection of the differential chart immediately tells us the pressure drop across the odorizer and the variation in pressure and flow characteristics during the week. Many troubles can be diagnosed by inspection of the differential chart, and I would not install an odorizer without one.

Calibration of odorizer storage tank

A barrel unloader is connected to a 50-gal. drum of kerosene in such a manner that it will empty into a 5-gal. can mounted on top of the odorant storage tank. Measured 5-gal. quantities of kerosene are emptied into the odorant storage tank and readings of the Magnetron gauge are noted, thus establishing a storage tank calibration curve. Using the 100-gal. tank, 1% is 1 gal.; and using the 200-gal. tank, 1% is 2 gal. For simplicity's sake, it is desirable to use a tank of 100 or 200 gal. rather than an 85-gal. tank, which is used in the standard Peerless odorizer.

Calibration of the odorizer pump

The calibration fluid is allowed to fill the pump inlet compartment and reach its normal liquid level. The pump is manually turned at a speed that corresponds to the average operating speed, and the liquid being discharged from the pump is collected in a calibrated graduate. This is repeated at least three times until check readings are obtained. The measured discharge per pump revolution should check with the calibration curve furnished.

Test run

After the odorizer has been calibrated it should be placed on a seven-day test run with kerosene. The differential is adjusted to approximately 20-in. water column and the odorizer set to deliver one revolution per minute. No effort is made to adjust the odorizer to actual flow conditions as this test run is for the purpose of determining the mechanical condition of the odorizer. During this period the odorizer is checked for leakage and mechanical difficulties. At the end of the test, the odorizer is given a close inspection, and if nothing

is wrong it is ready to be placed in operation.

The reason we do not try to adjust to the actual flow condition is that we want an accelerated test to insure that the pump turns over a sufficient number of times to test the mechanical condition of the odorizer in a very short period of one week. Most of the trouble experienced has been due to pieces of welding rod or other foreign particles getting into the odorizer lines.

2. In-service experience

SUPPLEMENTARY odorization was begun on Line 1, one of the oldest lines in the system, at Porters Falls, W. Va., at the rate of 0.1 lb of BP Captan per million cubic feet on June 30, 1953.

Two days after the odorizer was turned on, a noticeable increase in leak complaints was evident at New Martinsville, approximately nine miles from the odorizer.

Seven days after the odorizer was turned on, the odor was definitely noticeable at Martins Ferry, Ohio, and Warwood, W. Va., a distance of approximately 39 miles from the odorizer.

Two weeks after the odorizer was turned on, the odor had spread through the distribution systems of all the towns along the pipeline and had reached Bellaire, Ohio, a distance of 70 miles from the odorizer.

Many of the service calls were caused by leakage at customers' appliances, particularly leakage on ranges where the valves had become dry. In many cases the pilot was not lighted, but previously pilot leakage had not been reported by the customer. A great many leaks showed up in house piping, and it was impossible for the plumbers in the area to keep up with the volume of work. Sometimes as much as four days elapsed before the house piping could be repaired. A number of broken service lines were discovered. One leak was a broken 10-in. medium pressure line. The break was located 500 ft from where the odor was reported by a customer.

As the larger leaks were repaired and the leak complaints subsided, it was possible to gradually increase the odorant over a six-month period from an initial 0.1 to the present 0.5 lb of BP Captan per million cubic feet.

Cutting out the head of an empty odorant barrel.

Higher odorant rates are not desirable because they result in nuisance leak complaints, such as delayed burner ignition.

Customer service calls due to gas leaks have increased from 0.5 leak complaints per thousand customers per week before odorization, to between 3 and 4 leak complaints per thousand customers per week after odorization.

Total customer service calls have increased from 8.3 service calls per thousand customers per week before odorization, to 11.8 service calls per thousand customers per week after odorization.

Blowing down the odorant storage tank

The best way to eliminate odor when blowing down an odorant storage tank is to pipe the gas to a flare burner where the odor is eliminated by complete combustion. The flare burner is a 1-in. John Zink, Series Z2, gas burner complete with stainless steel orifice and 29% chrome, 2% nickel steel tip.

We have installed a check valve and flash-back arrangement to make it impossible for this burner to flash back into the odorant storage tank. We have also installed a continuous burning pilot in such a fashion that it can be lighted before the odorant storage tank blowdown is started and will continue burning after the blowdown.

This method will also consume the gas displaced as the odorant storage tank is filled with liquid.

Disposal of empty odorant barrels

It is not recommended that barrelheads be cut out with a hammer and chisel because of the possibility that the empty barrel might contain an explosive gas-air mixture. A simple way to dispose of empty odorant barrels is to cut out the head of the barrel using the Gardner barrelhead cutter, Model 200. It is not practical to purge the barrels with steam or inert gas because of the odor that escapes during the purging operation. After cutting out the barrelhead, pour in a quart of non-leaded gasoline and set fire to the barrel. After the barrel has been burned out, it does not smell and can be used as a trash container or sold for junk.

The alternate method of disposing of barrels is to accumulate them and sell them to a junk dealer for $1 each, or they may be returned to the Captan Co.

Checking odor variation

Two portable Titrilogs have been purchased from the Consolidated Engineering Corp. at a cost of $4000 each. This device is a chemical-electronic instrument designed to continuously record the concentration of trace quantities of oxidizable sulfur compounds in a gas stream.* The instrument has a threshold sensitivity of 0.1 parts per

*See "Titrilog" in the June 1950 issue of *GAS*.

TABLE 1. DETAILED COST ANALYSIS OF WAYNESBORO ODORIZER

Description		Price
Odorizer unit		
1—Peerless odorizer, Type MP-1-600, designed for 600 psig operating pressure at 100° F in accordance with Pennsylvania Regulations for Unfired Pressure Vessels and equipped with:		
(1) Storage tank (200-gal. capacity) with 8-in. Magnetron liquid level gauge, Model No. 3136-CD		
(2) Odorizer unit with armored sight glass and revolution counter		
(3) Safety overflow tank (200-gal. capacity)		
(4) ¾-in. Hancock Flo-control valve		
Odorant pump to be sized for: Minimum flow of 15 MMcf/day at 450 psig Average flow of 30 MMcf/day at 300 psig Maximum flow of 60 MMcf/day at 600 psig		
Cost F.O.B. Dallas, Texas:		
In single units	$3,030.80	
In lots of 5 units	2,952.40	
In lots of 10 units	2,674.00	$2,674.00
Peerless automatic precision valve		90.00
Freight by truck from Dallas to Waynesboro, Pa.		280.00
Odorizer thermometer		
1—Weston heavy duty dial thermometer, Model 1221, range 40 to 160° F Dial size, 5 in. Dial position, stem on top		
Cost in single units	$43.00	
Cost in lots of 10 units	34.40	34.40
Differential gauge		
1—12-in. Foxboro orifice gauge, Type 200, 0-500 psig, 0-100-in. of water, seven-day, spring-wound clock, Type H gauge piping		186.20
Odorizer valves		
5—½-in. Kerotest packless diaphragm valves, Model R42U04P at $17.50		87.50
Odorizer foundation		
1—¼ cu yd concrete (sand, gravel, cement)	$19.55	
115 ft of ⅜-in. round reinforcing rods	4.93	
30 ft of ⅛-in. round tie rods	.26	
4—⅝-in. by 15-in. track head bolts	.38	
Lot—Foundation lumber	21.56	46.68
Flare burner		
1—1-in. John Zink gas burner, Series Z-2, complete with stainless orifice and 29% chrome, 2% nickel steel tip		
Cost in single units	$43.50	
Cost in lots of 20	40.00	40.00
Flare burner valve		
1—¾-in. Walworth gate valve, Type 316, with stainless steel trim No. S-5255		14.45
Odorizer piping		
104 ft—¾-in. P.E. steel tubing, X.H.	$39.00	
4—½-in. X.M. steel collars, steel, screwed	.46	
2—½-in. C.I. plugs, steel, screwed	.06	
7—½-in. x 2-in. X.H. nipples, steel, screwed	.98	
3—½-in. x 3-in. X.H. nipples, steel, screwed	.63	
1—½-in. x 6-in. X.H. nipple, steel, screwed	.21	
1—½-in. x 8-in. X.H. nipple, steel, screwed	.21	
3—¾-in. x 3-in. X.H. nipples, steel, screwed	.33	
2—½-in. X.H. unions, steel, screwed	1.76	
1—¾-in. X.H. union, steel ,screwed	.96	
2—½-in. X.H. ells, steel, screwed	.27	
8—¾-in. X.H. ells, steel, screwed	1.04	
3—¾-in. x ½-in. X.H. reducers, steel, screwed	.43	
1—1-in. x ¾-in. X.H. reducer, steel, screwed	.19	
5—¼-in. needle valves, Lunkenheimer, Fig. 1728	14.25	
1—¼-in. Catawissa union	.60	
5—¼-in. ells, steel, screwed	2.10	
15 ft—¼-in. steel gauge tubing, 1500#, t = .088 in.	3.12	66.60
Drum unloader		
1—Drum unloader		37.50
Drum unloader regulator		
1—¼-in. Fisher regulator, Model 1301-F, Max. Inlet: 3000 psig; discharge: 50 psig	$16.50	
1—¼-in. Fisher regulator, Model 67-FR, Max. Inlet: 250 psig; discharge: 8-oz water column	11.00	
Miscellaneous fittings	9.91	37.41
Drum unloader piping		
25 ft—¼-in. I.D. Schrader air hose (150#)	$ 6.25	
15 ft—¾-in. copper tubing, standard weight	7.95	
1—1-in. Series 15, blind flange, tapped to ¾ in. with ¾-in. nipple and collar (loading flange)	11.53	25.73
Barrelhead cutter		
1—Gardner barrelhead cutter, Model 200		150.00
Freight		5.00
Mainline valve installation		
Mainline valve, 12-in., Fig. 4749½	$1,113.66	
Mainline fittings	481.21	
Installation cost	500.00	2,094.87
Operating supplies		
Calibration liquid: 4—55-gal. drums kerosene	44.00	
Odorant: 3—55-gal. drums BP Captan	675.00	
Deodorant: 12—1-lb cans of Captan Wafto	18.00	737.00

million or .005 grains of sulfur per 100 cu ft. It will record changes in sulfur concentration in a matter of seconds.

Without this instrument it is impossible to check the variation of odor intensity in a gas stream. At the present time, however, we do not feel that it is necessary to install a Titrilog downstream from each odorizer.

The Titrilog makes it possible for us to compensate for variations in line pressure much more accurately than would otherwise be possible. The Titrilog has, in several instances, pointed out variations in odor intensity caused by breathing of the odorant storage tank and by hunting of pressure regulators at bypass odorizer installations in New York state.

Troubles experienced

1. Trouble was experienced with the float valve sticking in an open position. The contents of the storage tank overflowed into the safety overflow tank, and no trouble was experienced due to excessive odor in the pipeline. The odorizer unit was removed from service and a small piece of welding rod was found stuck in the float valve.

2. Trouble was experienced with a defective revolution counter which stuck in a fixed position. The pin sheared on the index shaft of the gas meter. After the revolution counter was replaced, no further trouble was experienced.

3. Trouble was experienced with the pressure compensating valve. We believe the trouble has been eliminated.

4. Trouble was experienced with condensables in the natural gas from two of our underground storage fields. In each case the odorizer was located downstream from the point where the pressure was reduced from 1000 psig to 200 psig. The low temperature and high water content of the gas coming from these underground storage fields caused the odorizer meter to stop when it became filled with condensables and gas hydrates, which looked like slush ice. This problem is being solved by reinstalling the odorizer upstream from the pressure cut. As a precautionary measure, we are installing a 6-in. Peerless line separator with ¾-in. inlet and outlet connections on the line into the Peerless odorizer.

A detailed materials list for a typical odorizer installation is shown in *Table 1.*

You will also be faced with the problem of purchasing the necessary materials required for construction of an odorizer. We are including a detailed materials list showing the items of equipment to be purchased, and the cost of each item.

ROPER

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2ND PRIZE

3RD PRIZE

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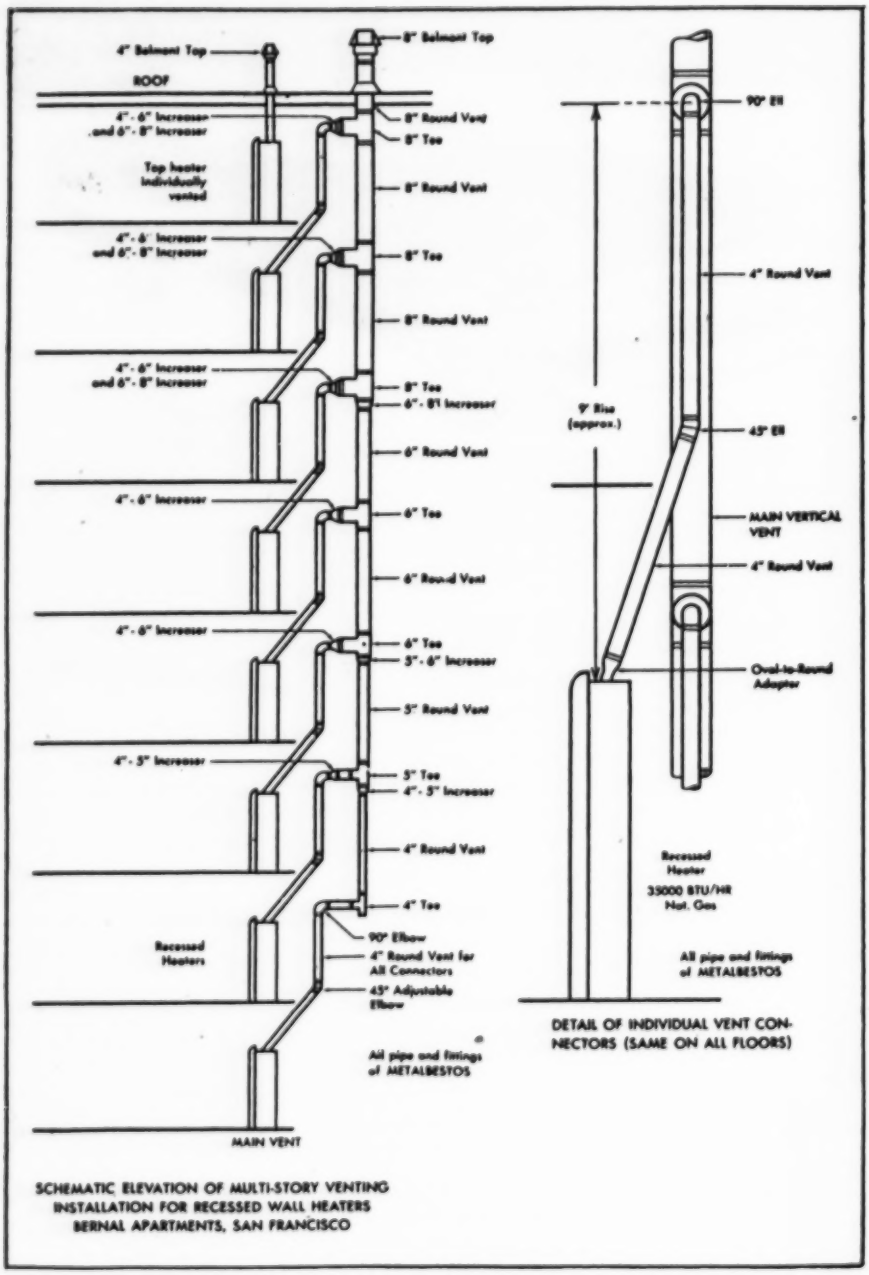
Apartment house heating problems solved by multi-story vents

By **E. C. ADAMS, President** • Adams Bros. Manufacturing Co. Inc., Pittsburgh



Elevation diagram of typical tier type vent arrangement.

RESETTLEMENT of families living in sub-standard housing is an increasing problem in many cities. Most proposed solutions involve the construction of large multi-story apartment buildings separated by garden spaces.

In 1951, U. S. Housing and Home Finance Agency sponsored a special research project to explore possibilities of lessening the first cost and operation costs of such structures. One item that apparently offered opportunity for substantial savings was the heating arrangement—use of natural gas in individual apartment heating devices instead of the usual large central heating plant. However, this approach presented the problem of multi-story venting for which there seemed to be no ready solution. The problem was studied initially by GAMA's coordinating committee for individual apartment heating in multi-story housing research.

Eight-story unit

Later, as a consequence of research, a company agreed to design, build and guarantee vents, which were installed in the eight-story apartment unit of the Bernal buildings project, San Francisco, Calif.

The apartment building was completed last fall and is composed of 64 apartments. In October and November comprehensive tests were made to observe operation of the installations. Results of the field tests showed that multi-story vents of individual apartment

Mr. Adams is also chairman of the coordinating committee for individual apartment heating in multi-story housing research of the Gas Appliance Manufacturers Association.

heating devices are practical if properly designed. It may be concluded that the vents in the Bernal apartments are properly designed and function efficiently.

Conclusions obtained from a review of the field inspection report along with an elevation diagram of a typical tier vent arrangement provide information on some important elements of the vent design.

Ten stories possible

While the Bernal apartments are eight stories, the calculations governing flue operation indicate that a similarly designed flue system with the same flue gas temperatures could handle a 10-story building without difficulty.

Effectiveness of a multi-story vent arrangement is dependent primarily on the amount of heat in the vent gases and the degree of conservation of that necessary heat by means of well insulated flue passageways. When gases are elevated in a flue system, substantial weights are moved. For example, the weight of the flue gases resulting from the combustion of 1 Mcf of natural gas in heating service is approximately 2400 lb. Heat energy in the flue gases is the source of power needed to move such substantial weights.

It is apparent, therefore, that when multi-story vent systems are planned, considerable care should be taken to engineer the vent designs after acquiring data on the characteristics of the equipment to be vented. This is important because various types of equipment differ considerably as to their flue gas temperatures.

Flue gas temperatures

For example, it is well established that the flue gas temperatures of water heaters are considerably lower than the flue gas temperatures of vented recessed wall heaters, such as those in the Bernal apartments. Therefore, the height at which water heaters can be successfully vented is lessened. In the Bernal apartments, hot water is supplied from a central water heating unit.

Another important element in design is the necessity of avoiding the possibility of flue gases from one apartment back-flowing into another apartment. In the Bernal apartment design there is sufficient rise in the individual vents to insure satisfactory discharge to the main stack without aid from the venting power in the main stack. This design provides proper venting of each unit without dependence on the operation of any other unit. It practically precludes the possibility of reverse flow from the common stack.

Important step

This bold venture in multi-story individual apartment venting is an important step in reducing the cost of multi-story housing. It is also an important contribution to possible future markets for gas appliances and gas.

American Gas Association's venting research program is proceeding by thorough studies and laboratory testing of theoretical conclusions. Efforts of cooperating industry members, such as this example, help to speed the day when venting apartments for the gas industry's products will contribute substantially to satisfactory service.

Scientific modernization of the old-time chimney has for many years lagged far behind the needs of modern dwelling conditions. Correction of that situation will be a major step forward in the industry's progress.

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"Packaged" district regulator devised by Dallas engineers

A PACKAGED low pressure district regulator unit, which can be installed on the job in less than three hours, has been developed by Lone Star Gas Co. engineers.

Constructed under the supervision of A. B. McCurdy, distribution engineer, Dallas division of distribution, the prefabricated unit is built in the shop instead of being assembled on the job location as heretofore. This means the unit can be constructed more skillfully, faster and cheaper. They are also more durable than the previous installations.

Because the new package units do not require a concrete pit, which requires forms, pouring, and hardening of concrete and construction of a steel cover, installation time has been cut from days to hours.

The unit, which fits conveniently in the parkway space between sidewalks and curb, is encased in a ¼-in. welded steel box with tread-steel, double-hinged lid, which rests flush with the ground level when installation is completed. The differential-type pressure booster unit is entirely automatic, requiring only a periodic service inspection and a weekly chart change.

Although the unit basically has the same design as older installations, it is more compact and control piping has been modified to provide extra working space within the unit enclosure when service and repairs are made.

An 8-in. neoprene gasket fitted beneath the new unit's cover has helped to make it almost waterproof.

Cathodic protection has been used on the new regulator installations with two 32-lb anodes buried in the ground at each location and connected to the unit with No. 12 copper wire. It's enclosed in a 1-in. vertical pipe fitted with a curb box valve at the top where the terminal wires are accessible. The cathodic protection can be accessible for periodic tests.

In installations using cathodic protection the regulator unit is isolated from the pipeline system by insulating sleeves.

Pits for the new units can be dug with backhoe instead of by hand, a distinct saving in time and labor. On the bottom of each pit, a 6- to 8-in. wooden form is built and filled with sand mixed with concrete. A steel thimble of 16-in. pipe is also placed in the sand area into which is fitted the unit's 12-in. sump. With the unit lowered into place, sides are filled in with sand and the entire installation is watered to set the concrete and sand mixture.

The first two units were installed in June on Oakland and Lawrence streets in South Dallas, and on Oak Lawn at Maple near Parkland hospital in North Dallas.

All units are equipped with type 29 Fisher pressure relief valves. Stacks include an 8-in. fresh air inlet and a 10-in. exhaust for fresh air circulation. A recording gauge has been installed in a box on the stack. All stacks are welded into the unit after it has been set.

The welded steel box that houses the low pressure district regulator.

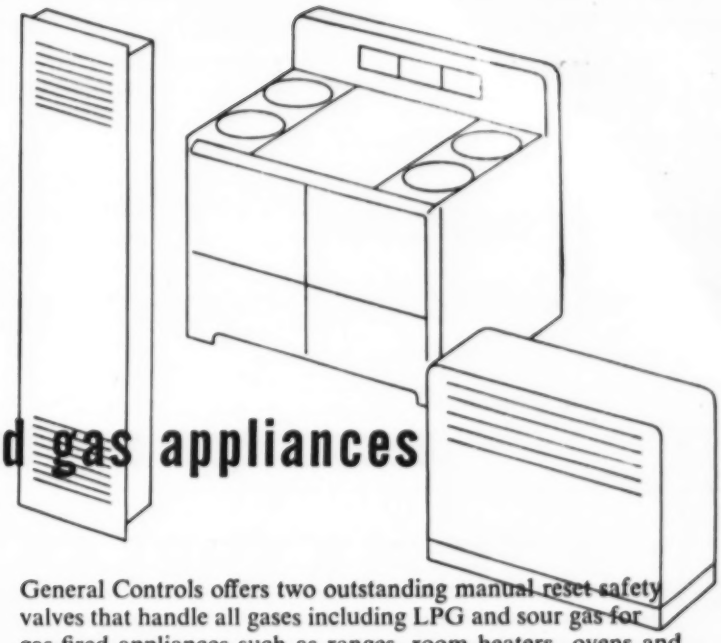
The fresh air inlet stack and exhaust stack for fresh air circulation. Note box housing recording gauge.

Cathodic protection in the form of 32-lb anodes is provided. Two such anodes are buried at each location and are connected to the unit with No. 12 copper wire.

The 6- by 8-ft wooden form which is built on the bottom of each pit. In the center of the pit is the 16-in. pipe into which the 12-in. sump is fitted.

Compact dependable safety shutoff

for heating and gas appliances



MR-3
MR-4

General Controls offers two outstanding manual reset safety valves that handle all gases including LPG and sour gas for gas-fired appliances such as ranges, room heaters, ovens and boilers. Available in ¼", ⅜" and ½" IPS or for ⅜" or $\frac{7}{16}$" tube connections, the MR-3 and MR-4 thermomagnetic push button reset valves are available with pilot take-off, without pilot take-off or with auxiliary valve for independent pilot flow and pilot adjustment. The MR-3, a nonflow interrupting type with 100% gas shutoff, can be installed upstream of the automatic valve. The MR-4 valve is identical, however, it includes flow interruption during pilot reset. MR-3 and MR-4 valves are powered by a single thermocouple which supplies necessary operating current. For compactness, dependability choose the A. G. A. approved General Controls MR-3 and MR-4 Manual Reset Thermopilot valves. A variety of pilot burners and thermocouple combinations are available for every appliance application. For further information, request Bulletin 608.170.

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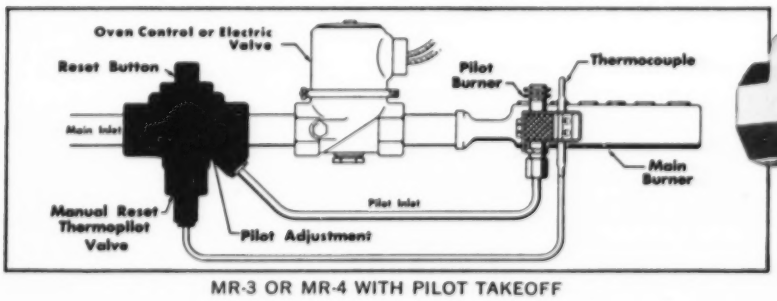
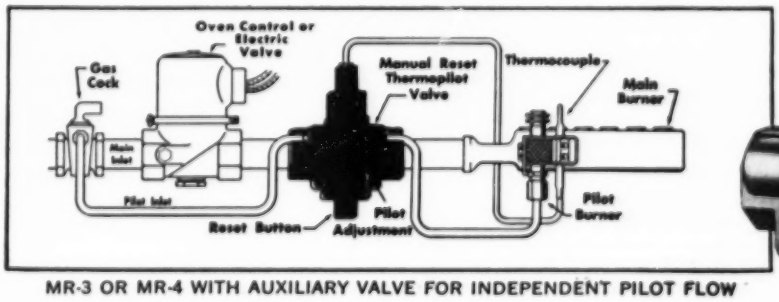
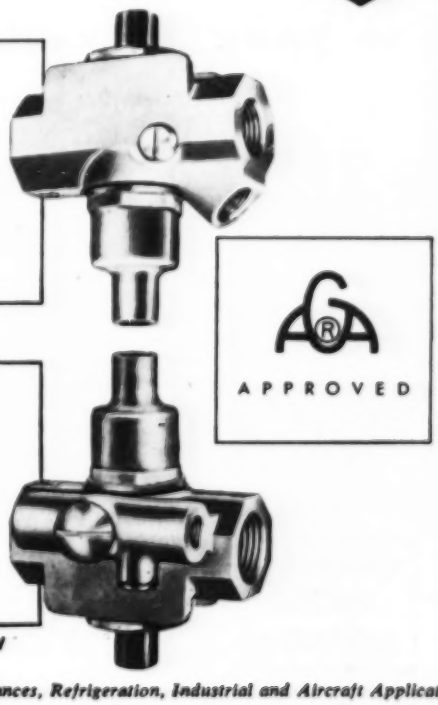


MR-3 OR MR-4 WITH PILOT TAKEOFF



MR-3 OR MR-4 WITH AUXILIARY VALVE FOR INDEPENDENT PILOT FLOW



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Thermally Thinking

Continued from page 32

may be stymied, temporarily at least, as an indirect result of the Phillips decision. This is said to be particularly true of applications for gas rate increases in which the transmission companies must give proof of additional reserves to supply new customers.

The "escape clause," written into many contracts by producers, is the basic reason for this difficulty. This allows the producers to withdraw their gas supply under conditions that now prevail. They were written, in fact, in anticipation of the prospects of a court ruling that *did* materialize.

Fuel policy again

The question of a "fuel policy" has reared its ugly head here again, and, it goes without saying, the emphasis is being placed on formulating such a policy in the executive branch, rather than on Capitol Hill.

President Eisenhower, pressured from only-the-good-Lord-knows-where (or maybe the coal mine owners know, too!), has created an interdepartmental committee to study the "continued development of energy supplies and resources and fuels."

The committee, it was said, will review all factors relating to the needs and supplies of major sources of energy, including coal (anthracite, bituminous and lignite, as well as coke, coal tars, and synthetic liquid fuels), petroleum, and natural gas.

Uncle Sam, as is well known, also has separate committees looking into ways of helping the declining hard and soft coal industries, but no one wants to come to direct grips with the problem, for that will put him right up against John L. You-Know-Who.

The fuel committee named here will be known as "The Cabinet Committee on Energy Supplies and Resources Policy." It is composed of the chairman of the Office of Defense Mobilization, and the Secretaries of State, Defense, Interior, Commerce, and Labor, and the Attorney General.

It is to report recommendations to the President by Dec. 1. One Washington observer, of caustic wit, said that the Republican cabinet members probably would spend much of their time studying reports of hearings held in other years by the subcommittee of the Senate Committee on the Interior, for former Sen. Joseph C. O'Mahoney (D.-Wyo.) held this as one of his constant projects during a long tenure in the Senate.

Government publishes list of inventories

Encouragement to American industry to take advantage of the products of federally sponsored technical research was seen here in the publication of "Instrumentation," a weighty volume listing 775 federally owned inventions in the field of instrumentation, with a brief description of each invention.

Dr. Archie M. Palmer, chairman of the Government Patents Board, which sponsored the publication with the Small Business Administration, pointed out that these inventions usually are available for use on a royalty-free license basis. Besides the description of

(Continued on page 76)

A TRIPLE THREAT

to your operating efficiency

Unless this rampaging menace is stopped short of the goal, your engines, your equipment and your entire processing system will remain vulnerable to its attacks.

H_2S can be stopped — dead in its tracks — by America's most effective, most economical, most proven gas purification method known today — Connelly IRON SPONGE! Yes, this simple, high-capacity product can be depended upon to cleanse any flow—at high or low pressure—of hazardous Hydrogen Sulphide . . . and also to lower operating and maintenance costs. IRON SPONGE renders this service prolongingly — subject to easy rejuvenation.

Despite its thoroughness and over-all superiority, Connelly IRON SPONGE spreads its low cost thin through each 1000 feet of gas. To get the full facts about this effective purifier, write, wire or phone Connelly — today. Our engineering department is at your service.

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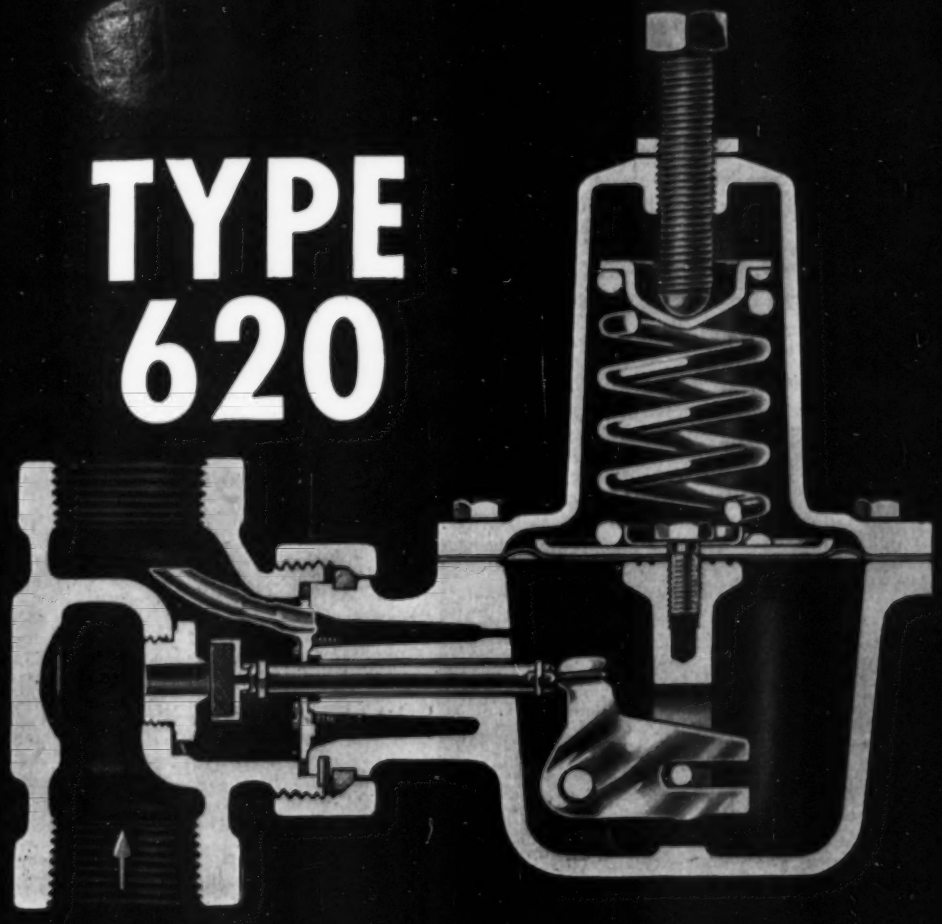

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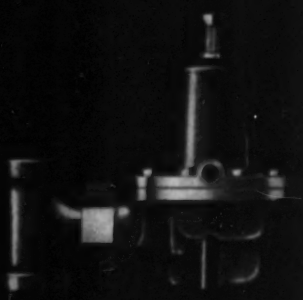


The Fisher Type 620 pounds to pounds regulator is *especially designed* for *first stage reduction of gas pressure for farm taps* on high pressure transmission systems.

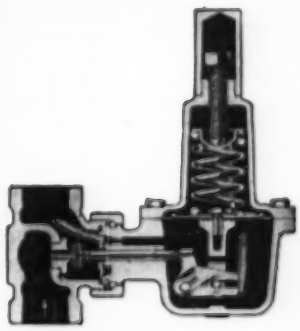
Also suitable for industrial air service applications, as a Propane tank reducing valve, and for *numerous other installations* where good regulation is required on air or gas service.

Type 620 has alloy lower casing and spring case. Also available as Type 621 which is same as Type 620 except it has cast iron lower casing and spring case, and has sealing cap on adjusting screw.

For inlet pressures up to 750 psi with malleable iron or cast steel body; up to 150 psi with cast iron body. Outlet pressure ranges: Type 620—3 to 60 lbs. (4 springs). Type 621—3 to 100 lbs. (5 springs).

Sizes: ¾", 1" and 1¼" with cast iron or cast steel body. ¾" and 1" with malleable iron body.

Write for details.



Sectional view of Type 621 showing closing cap on adjusting screw.

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Continued from **page 72**

the inventions, each listing gives the patent number, the title of the invention, the name of the inventor, and the federal agency administering the patent.

As to the practical value of the book to industrialists who are interested in instrumentation, Dr. Palmer cited several specific inventions of commercial applications, including a process for testing the embrittlement cracking characteristics of solutions, a device for detecting radioactivity, a fluid selecting apparatus for handling corrosive liquids, a pocket radiation alarm, a pocket radiation meter, a humidity measuring device, a remote control manipulator, a detector for carbon monoxide, and a pressure measuring device, among others.

The book (Order No. 111464) may be purchased ($2) from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. It is the first of a series of seven to be prepared under the aegis of the Government's Patents Board and the Small Business Administration.

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"After running a cost analysis on installation cost we found where any saving of time that could be affected made a decided change in the final cost per anode installation. By using an anode that didn't require recentering before installation we saved 5 man min. per anode or a cost saving of 10¢ an anode.

Yes Sir, that's what I call a real cost saver, Standard's VIBRA-PAK'd anodes."

— VIBRA-PAK anodes are spectrographically analyzed for metal purity . . . *your guarantee of longer serivce life!*

— a new, patented spiral core won't separate from anode . . . *positive contact is assured!*

— and remember, VIBRA-PAK means the anode is compacted and centered in the backfill through shipping, handling and placing it in the hole.

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People

Promotions

A research department has been created by Peoples Gas Light & Coke Co., Chicago, which will function for Peoples Gas and its pipeline and storage subsidiaries. MATTHEW E. BENESH heads the department, E. G. HAMMERSCHMIDT is assistant director, and DR. J. D. PARENT is research associate. A new testing department is headed by HUGH E. FERGUSON as chief testing engineer; STANLEY J. MODZIKOWSKI is chemical testing engineer; FRANK C. WITTING is plant testing engineer; WILLIAM D. EGAN is utilization testing engineer; and JAMES CRANE JR. is assistant utilization testing engineer. General superintendent of the distribution department is ERNEST G. CAMPBELL, assisted by THOMAS R. BOGUMILL.

J. H. Walters **T. I. Stacy**
Rockwell Manufacturing

JACK H. WALTERS, Houston district sales manager of Rockwell Manufacturing Co.'s meter and valve division since 1951, has been named gas products manager for the entire division with headquarters in Pittsburgh. THOMAS I. STACY, a sales engineer in the Houston district since 1940, succeeds him as district manager.

CEC Instruments Inc., sales and service subsidiary of Consolidated Engineering Corp., Pasadena, Calif., has named JOSEPH E. JENKINS manager of the Washington, D. C., district office. Consolidated Engineering has also announced the election of JAMES R. BRADBURN as president of ElectroData Corp., an affiliate, succeeding PHILIP S. FOGG, who will continue as chairman of the board. HENRY SALVATORI, president of the Western Geophysical Co., has been elected to the board of Consolidated.

GLENN A. BARNES has been advanced to general sales manager of Sequoia Manufacturing Co., San Carlos, Calif. He has been succeeded in his southern California sales post by JOHN S. PATRICK.

EDWARD K. KALLA has been promoted to sales manager of Anesite Co., Chicago manufacturer of plastic pipe.

L. W. COUGHLAN has been promoted to assistant comptroller and T. R. SALM has

Caloric's dramatically new built-in gas cooking units give new freedom in kitchen planning. Another Caloric product, planned to pay off for you . . . and like every Caloric appliance, it is planned exclusively for gas

No wonder Caloric built-in gas cooking equipment is gaining fast acceptance. It affords builders, architects and home owners an unmatched flexibility in planning kitchen layouts. Of course, these Caloric units offer the many advantages of gas equipment, including eye-level visibility for controls . . . and no worries about broiling with the oven door open. There's no doubt about it . . . feature for feature, dollar for dollar, built-in Caloric units offer more for less than any other on the market. Ask your Caloric representative to explain why Caloric built-in units are so vastly superior to all others.

Please send me complete information on the Caloric built-in gas cooking units.

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succeeded him as general auditor of Pacific Gas & Electric Co., San Francisco.

JOHN C. BOLENDER, formerly vice president of operations, has been promoted to vice president and general manager of Peoples Water & Gas Co., N. Miami, Fla.

VIRGIL F. BOWYER, 30-year veteran with Peoples Natural Gas Co., has been appointed manager-system gas supply for Consolidated Natural Gas Co., New York, the parent company.

J. C. Bolender
Peoples Water

V. F. Bowyer
Peoples Natural

W. J. Hancock
Grove

N. H. Gellert Jr.
Seattle Gas

Grove Regulator Co., Oakland, Calif., has opened a new district office in New Orleans and appointed W. J. HANCOCK as district manager. The company has also appointed five additional men to the Houston area sales engineering staff. They are: J. D. HICKS, assistant division sales manager; PAUL NEREN, C. B. WRIGHT JR., ELDON E. HULSEY, and F. J. BRADFORD.

NATHAN H. GELLERT JR. has been appointed coordinator of natural gas conversion for Seattle (Wash.) Gas Co. and DAVID D. RISSER is assistant coordinator. To handle the company's accelerated needs and problems, a new department of engineering has also been set up, with JAMES F. GARY as superintendent. VERNON H. DAMM has been named superintendent of distribution.

Eight managerial changes have been announced by Lone Star Gas Co., Dallas. A. C. HALEY is Palestine manager, replacing J. V. MURDAUGH, retired; R. E. DAY succeeds Mr. Haley as Seymour district manager; FRANK C. GREVELLE is Ballinger manager; J. J. CRIM JR. heads the Denton district; GUY T. WHITE is Quanah sub-district manager; H. L. DYER is Wichita Falls manager; MACK M. YOUNG heads the Taylor district; and GEORGE P. WILLIAMS the Corsicana district.

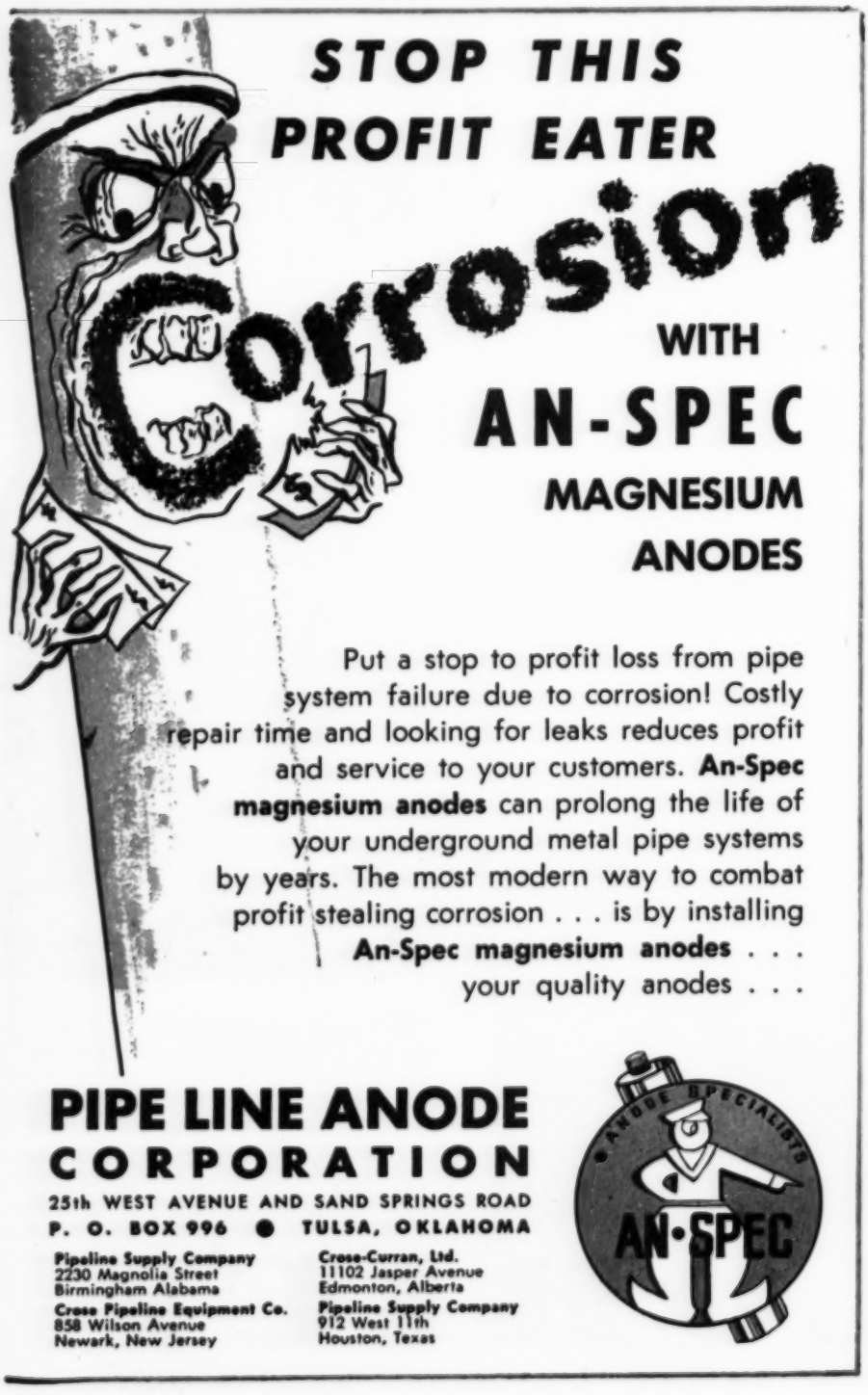
BERNARD E. GARDNER JR. has been appointed sales engineer by American Meter Co. and has been assigned to the Atlanta district.

Several division managers have been announced by Northern Illinois Gas Co., Chicago: CHARLES F. HENNESS, northern division; JOHN J. DIGNAN, central division; CHARLES W. TENNANT, western division; and RAYMOND O. STAUSS, southern division.

ROY J. SULLIVAN has retired from the Peoples Natural Gas Co., Pittsburgh, as supervisor of gas appliance sales. He began his career with the company in 1909.

F. AUSTIN BROWNIE has been elected president of Canadian Utilities Ltd., Edmonton, Alberta, succeeding B. M. HILL, who is retiring.

HOWARD J. EVANS, formerly chief engineer of the Pittsburgh Equitable Meter division, has been promoted to chief engineer and manager of the Central Gas Products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Put a stop to profit loss from pipe system failure due to corrosion! Costly repair time and looking for leaks reduces profit and service to your customers. An-Spec magnesium anodes can prolong the life of your underground metal pipe systems by years. The most modern way to combat profit stealing corrosion . . . is by installing An-Spec magnesium anodes . . . your quality anodes . . .
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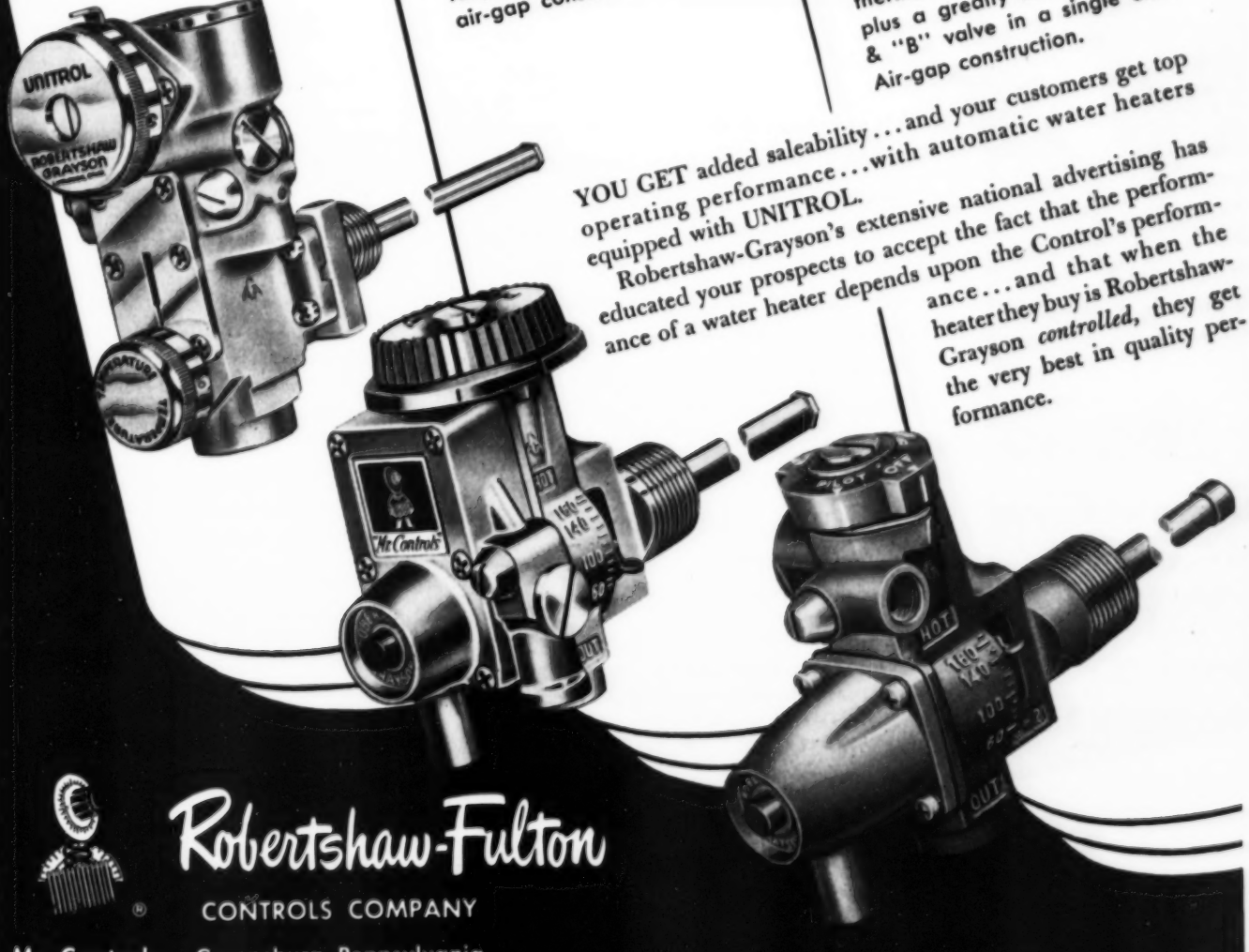
The "Cadillac" of Water Heater Controls. The 100% Control that has everything you could want for superior performance and dependability, including air-gap construction.

UNITROL® MODEL 102

New! a 100% shut-off type thermostat suitable for all gases, incorporating thermostat, safety pilot, gas cock, large-capacity built-in filter, air-gap construction.

UNITROL® MODEL B

Combines an accurate thermostatic control and positive thermo-electric automatic pilot plus a greatly improved "A" & "B" valve in a single unit. Air-gap construction.



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Mr. Controls Greensburg, Pennsylvania

ROBERTSHAW THERMOSTAT DIVISION, Youngwood, Pennsylvania • GRAYSON CONTROLS DIVISION, Lynwood, California

research and development department of Rockwell Manufacturing Co. H. A. ALTORFER, formerly chief engineer of the Nordstrom Valve division, Oakland, Calif., has been named chief engineer and manager of the Central Valve research and development department.

JOHN C. FINN has been promoted to the post of New England sales agent for the United States Pipe & Foundry Co., Birmingham. He succeeds R. E. SWEENEY.

LOUIS T. M. RALTON, president of Industrial Brownhoist Co., has been elected president of the Quick-Way Truck Shovel Co., Denver. New chairman of the board is OSCAR L. CHAPMAN, and WILSON H. MADDEN has been appointed vice president and general manager.

P. K. WALLACE, general superintendent of Oklahoma Natural Gas Co., Tulsa, has been promoted to operating vice president, succeeding HERBERT H. ROSS, who has resigned.

GEORGE SAUM has become manager of the Taylor Forge Aircraft Products division of Taylor Forge & Pipe Works, Chicago, and T. E. MARSTON is now general sales manager of the division.

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STURDYBILT HOUSES COMPLY WITH COMMERCIAL STANDARD CS125 OF THE NATIONAL BUREAU OF STANDARDS FOR PREFABRICATED HOMES

Servel Inc., Evansville, Ind., has promoted G. O. KUHEN, former assistant air conditioning service manager, to the newly created position of technical assistant to the manager of the air conditioning division. The company has also promoted R. L. KIRSE assistant service manager of the division.

Transfers

OAKAH JONES, formerly general manager of the Oklahoma Natural Gas Co., has succeeded E. J. TUCKER as general manager of the Consumers' Gas Co., Toronto.

H. A. EDDINS has resigned as executive vice president of Laclede Gas Co., St. Louis, to assume a similar position with Oklahoma Natural Gas Co., Tulsa.

C. L. Parkhill Jr.
Anchor

George Beese
Universal

C. L. PARKHILL JR. has been appointed western division sales manager of Anchor Petroleum Co. He will be located in San Francisco, which will be headquarters of Anchor sales of the western division. General offices of the division have been moved from 3970 Atlantic Ave. to 1140 E. San Antonio Dr. in Long Beach, Calif.

New faces

GEORGE BEESE has joined Universal Controls Corp., Dallas, in the executive capacity of plant manager in charge of all production and purchasing.

EDWIN M. KAUFMAN has joined the Goldak Co., Glendale, Calif., as chief engineer in charge of research and production.

ROBERT L. HOGUET JR., vice president of the National City Bank of New York, has been elected a director of Consumers Power Co., Jackson, Mich.

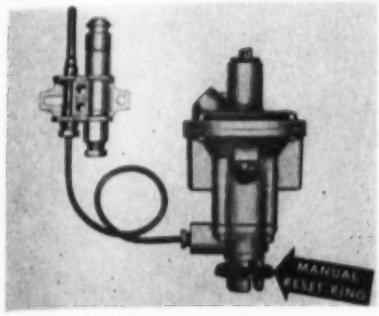
RHEA SHIELDS has joined Robertshaw-Fulton Controls Co. as director of home economics. She will headquarter in the company's research center at Irwin, Pa.

WALKER G. THORSBY has joined the Anaheim division of Robertshaw-Fulton Controls Co. as field engineer in the company's new Washington, D. C., office.

JOHN W. DARR has joined ACF Industries Inc. as director of public relations and advertising.

New Products and Trade Literature

To secure further information on products or new literature, simply fill out the coupon and mail, indicating by number the information or literature needed.



1 Regulator-Safety Pilot

Thermac Co. is offering manufacturers of wall heaters, forced air furnaces, etc., a combination appliance regulator and thermoelectric safety pilot with AGA certification for use with natural and manufactured gases.

The use of the new Thermac SR-100 effects a saving not only in installation cost but through the elimination of an electric relay or separate automatic pilot unit. The SR-100, being compact in design, is suited for wall heater and space heater installations. It is also designed for forced air, gravity and unit heaters up to and including 85,000 Btu natural gas.

To load or energize the thermocouple, simply pull down on the manual reset ring. The regulator itself is essentially the same as the T Series Thermac. The unit may be tapped on either side for a pilot take-off. The thermocouple lead take-off may be assembled in four different positions to facilitate ease of installation.

Thermac Co.

■

2 Aluminum Meter

With a rated capacity of 225 cu ft per hour of 0.6 sp gr gas at ½-in. w.c. differential, and working pressure of 5 psi, the new 5B-225 Aluminumcase meter announced by American Meter Co. has been developed to meet the need for larger capacity, light weight, and low cost in positive displacement gas meters for domestic service.

Features of the new meter include the use of pressure die-cast aluminum alloy construction to reduce weight while providing high-impact resistance. Interior construction includes the use of percision machine operations throughout; permanently self-lubricated porous bronze bearings; choice of synthetic or leather diaphragms; and new grommet-type bushings. The index is of clear, high-impact strength plastic.

American Meter Co.

■

3 Pipe Connection

A new system for making pipe connections of all types in the gas field has been introduced by United Pipe Utility Suppliers. The system involves sleeves for steel-to-steel connections that become welded joints, sleeves for utilizing a new compound where welding is not practical, and a new leak clamp (pictured) for bell joint repair.

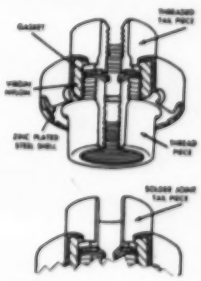
The sleeves for making steel-to-steel connections will withstand pressures up to 100 lb before welding through the use of a seal ring. Where plug-off and bypass equipment is used on high pressures, the sleeves save time in cutting and fitting in sections where it is desired to get the line purged and back in service without waiting for a weld to be completed.

The new leak clamp is of simple two-piece construction. It does not require adjustment or filling and facing of the bell, nor does the clamp bolt across the bell.

United Pipe Utility Suppliers Inc.

■

4 Pipe Union



New sizes in insulating or dielectric pipe unions, which serve as pipe unions and electric circuit breaks to stop the flow of stray electric currents, have been announced by Universal Controls Corp. A full range of sizes from ½ in. to 2 in. is now available.

The heart of the union is the insulating nut of zinc-plated steel shell containing a DuPont nylon core. Insulating pressure gaskets are of two types: one for water or steam, the other for gas, gasoline, oil and other fluids.

Universal Controls Corp.

■

5 Solenoid Valves

A new series of midget solenoid valves for handling all types of gases and liquids has just been introduced by General Con-

Mail this Coupon for **NEW PRODUCTS INFORMATION** / **COPIES OF NEW LITERATURE**

GAS, 198 S. Alvarado St., Los Angeles 57, Calif.

9/54 Fill in numbers of items in which you are interested.

No. ..... No. ..... No. ..... No. .....

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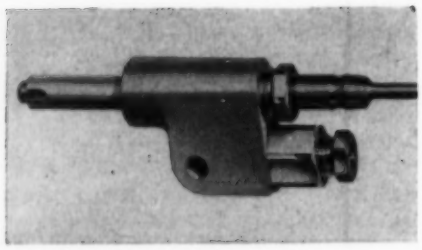
trols. The compact valves are available in many models for a variety of applications for control of fluids in the domestic, commercial, and industrial fields.

Aside from their small size, these new valves of the K-27, K-28, and K-29 series have soft seat, tight shutoff construction and are multipose. Among the new group are time-delay valves, manual reset valves, 2-way on/off valves, and 3-way valves. Aluminum, brass, and stainless steel are used as body metal to suit the application. In stainless steel types, all internal parts also are steel.

General Controls Co.



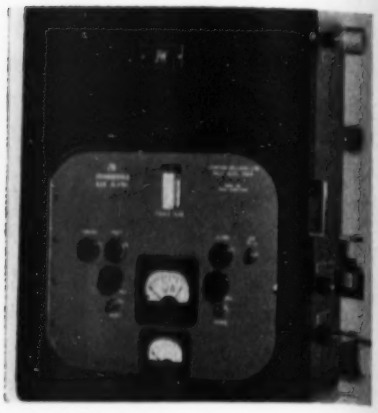
6 Non-Aerated Pilot

A new non-aerated pilot having unusually high flame stability is announced by Milwaukee Gas Specialty Co. The Model H10 pilot burner has a low consumption rate—75 to 100 Btu per hour with manufactured gas.

The thermocouple is surrounded by the pilot burner so that a small bead of flame continually bathes the thermocouple, generating the electricity that energizes the Baso safety pilot valve. The pilot burner is mounted in a horizontal position, making it easy to place in confined spaces.

Milwaukee Gas Specialty Co.

■



7 Gas Alarm

A compact, self-contained combustible gas alarm from Johnson-Williams offers explosion protection for single-point hazardous operations. The new J-W Model SM combines all operating functions into a single dust-proof cabinet designed for either surface or flush mounting.

The alarm is powered from a constant-voltage transformer operating on 115-volt, 60-cycle single-phase power; it requires 50 watts. Among its indicators and controls are the explosibility indicator meter; a zero adjuster; a separate voltmeter; a voltage adjuster; an indicating pilot light; an air-test button for admitting pure air; an alarm-test button; a sample flowmeter; an alarm light and reset button; and a built-in air pump for sample drawing.

Johnson-Williams Ltd.

■

8 Crane Excavator

Designed to handle fast and efficiently the many types of work now considered too small or restricted for profitable large machine operation, a mobile crane-excavator

ARCCO

BETA CHART PENS

...HOLD 2 to 4 TIMES MORE INK

Beta Fountain Pens hold two to four times the ink of ordinary chart inking pens. Regardless of the line thickness Beta Pens produce a smooth unbroken and uniform line. Pens shown are approximately actual size and can be arranged to reduce time interval between static and differential lines to only a few minutes. Beta Pens are especially suitable for seven day records. Price $1.10 (lower prices in quantities).

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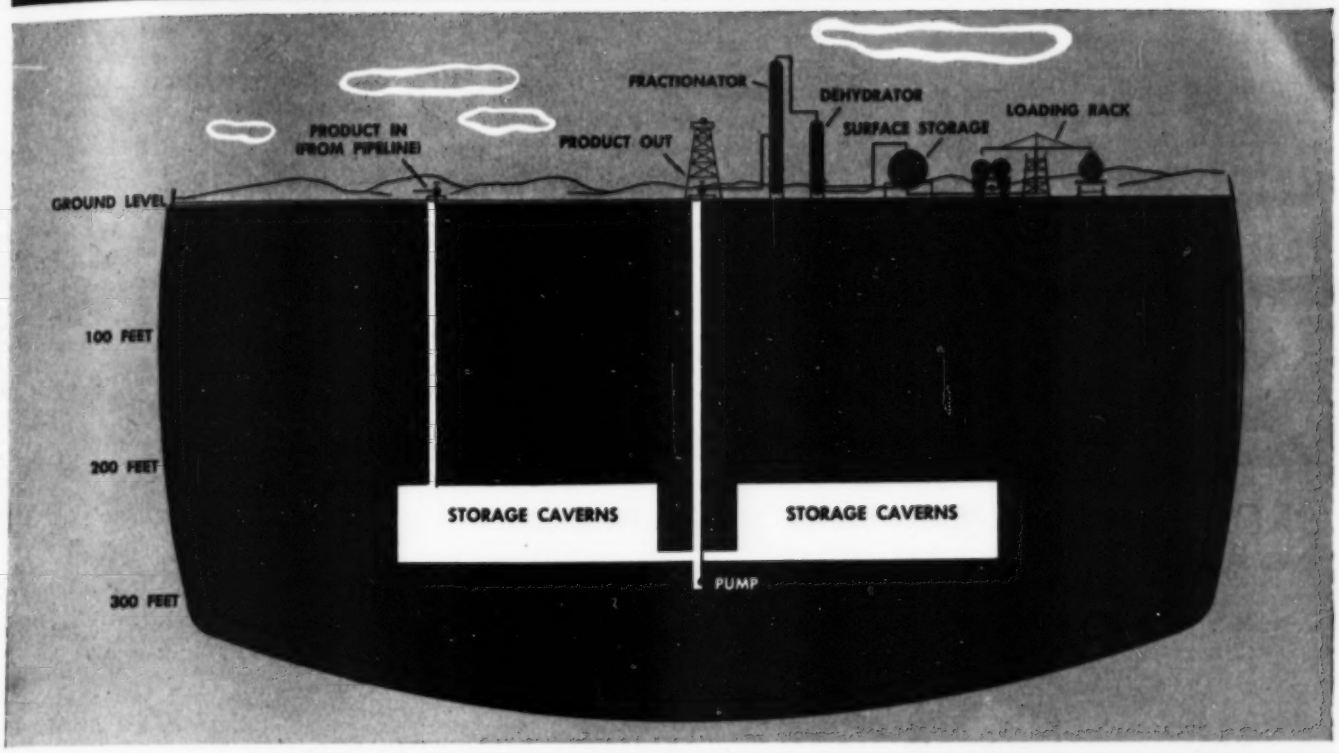
Available for Early Delivery

SEND FOR BULLETIN No. 110

HUGE NEW UNDERGROUND STORAGE CAVERNS ASSURE A DEPENDABLE SUPPLY OF PHILGAS*



*Philgas** IS AMERICA'S LARGEST SELLING LP-GAS

● Strategically situated underground storage caves are used by Phillips Petroleum Company to assure you of a dependable, year-around supply of LP-Gas. The storage cavern, illustrated above, mined from shale below the pipeline terminal at Kankakee, Illinois, stores nearly 300,000 barrels of Philgas for Chicago and the Great Lakes market. Phillips also maintains its own fleet of tank cars and trucks to provide prompt deliveries. As a Phillips contract customer, you can depend on a plentiful supply of Philgas at all seasons of the year.

*Philgas is the Phillips Petroleum Company trademark for its high quality propane-butane LP-Gas or bottled gas.

UTILITIES USE *PHILGAS* TO . . .

1. Replace manufactured gas with propane-air or to install new propane-air facilities.
2. Provide undiluted propane service to smaller towns.
3. Increase gas sendout with present facilities.
4. Enrich manufactured gas.
5. Act as standby supply in case of emergencies and at times of peak demand.
6. Underfire coke ovens.

Philgas
THE ALL-PURPOSE FUEL

PHILLIPS PETROLEUM COMPANY

Sales Department · Bartlesville, Oklahoma

Offices located in Amarillo, Tex., Atlanta, Ga., Chicago, Ill., Denver, Colo., Des Moines, Ia., Indianapolis, Ind., Kansas City, Mo., Minneapolis, Minn., New York, N. Y., Omaha, Nebr., Raleigh, N. C., St. Louis, Mo., Tampa, Fla., Tulsa, Okla., Wichita, Kans.

with 15-ton rated lifting capacity is being offered by Bucyrus-Erie Co.

The wheel mounting, built specially for crane-excavator service, is powered by a 138-hp White gasoline engine, equipped with single wheels in front and tandem duals in rear with 170-in. wheelbase. A heavy-duty, 5-speed transmission mounted in unit with engine and 2-speed auxiliary unit mounted in truck frame combine to provide 10 forward speeds to a maximum of 31 mph and two reverse speeds. Standard equipment also includes front and rear manually controlled telescoping outriggers.

Bucyrus-Erie Co.

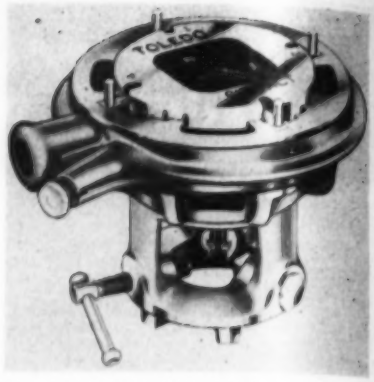
9 Ratchet Threader

The Toledo Simpact 1-in. to 2-in. self-contained ratchet threader is now offered by the Toledo Pipe Threading Machine Co. with a new improved cam-type quick-action pipe holder.

The new holder has broader jaws to permit more positive grip on the pipe, and free action cam that sets instantly to size. Quick and positive setting of Toledo Simpact high-speed steel dies can be made to four pipe sizes.

Simplicity of design has reduced moving parts in this tool, keeping wear to a minimum. It is light in weight and compact. Dies recede along tapered steps.

Toledo Pipe Threading Machine Co.



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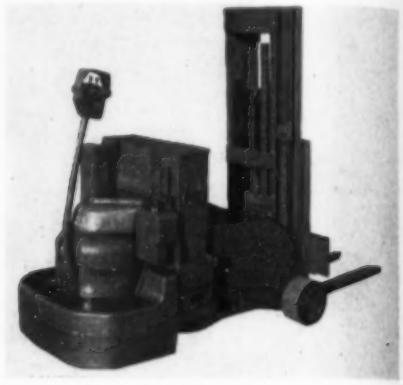


10 Industrial Trucks

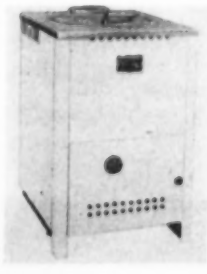
A complete line of standard industrial trucks made by Automatic Transportation Co. is now listed by Underwriters' Laboratories for semi-hazardous operations involving unusual fire risks.

Included in the latest listing are three BF standard Skylift models with rated capacities of 2000, 3000, and 4000 lb. The EE label was also awarded to three heavier fork lift trucks with rated capacities of 4000, 5000, and 6000 lb. The Transtacker pictured is designed to handle pallet or skid platforms in stacking loads up to 5000 lb.

Automatic Transportation Co.

■

11 Gas-Fired Incinerator



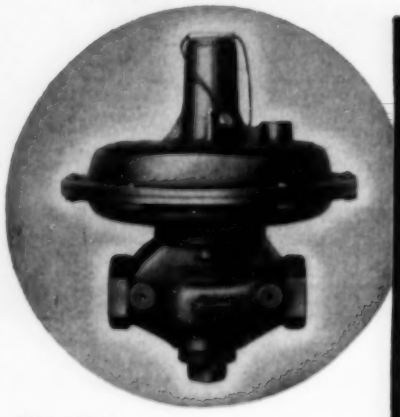
A new deluxe model gas-fired Incinor has been introduced by Bowser Inc. designed for LPG, natural, or mixed gases. The newly designed cabinet is finished in heat-resisting, stay-white baked enamel.

The 0-55A is suited for installation in utility rooms or modern basement playrooms. A positive-acting thermomagnetic valve controls the pilot at all times.

Bowser Inc.

Steady

REYNOLDS LOW PRESSURE REGULATORS



PIPE SIZES:
¼" to 8"
¼" to 3" with screw connections
3" to 8" with flange connections

REPRESENTATIVES:

H. D. "Mike" Meuffels
423 Dwight Building
Kansas City, Missouri

Seidenglanz & Co.
2nd Unit, Santa Fe Building
Dallas, Texas

Eastern Appliance Company
281 Vassar Street
Cambridge, Massachusetts

Waldo S. Hull
258 Lee Circle
Bryn Mawr, Pennsylvania

Reynolds Low Pressure Regulators guarantee steady, constant, unvarying outlet pressure even though the volume varies and inlet pressure fluctuates. Precision built and delicately balanced for accurate performance on low pressure installations, the units illustrated are backed by factory tests over a wide range of operating conditions. Reynolds Low Pressure Regulators are economical and safe. Our Engineering Department is at your service.

GAS CONTROL Since 1892

Reynolds Gas Regulator Co.
ANDERSON, INDIANA, U. S. A.

GAS CONTROL SINCE 1892

Trade Literature

12 Regulator Catalogs

Two new catalogs are available from Chaplin-Fulton. (When ordering copies, use letter preceding description along with number of this notice.)

(a) Bulletin 1100 describes the Chaplin-Fulton "1100" regulator, a versatile 2-in. pilot pressure loaded regulator for use where the inlet pressure does not exceed 250 psi with an outlet pressure range from inches of water to 150 psi and flows up to 215 Mcf per hour.

(b) Bulletin 461 describes Model 461 pressure regulators, a group of small balanced valve gas regulators that are generally used for 2-in. or 1½-in. service.

Chaplin-Fulton Manufacturing Co.

■

13 Clamps and Saddle Catalog

Clamps and saddles for steel or cast iron pipe are featured in a new catalog and manual from the M. B. Skinner Co. designated as Catalog No. GW. Several completely new products, including the coupling saddle and the wall service fitting, are shown for the first time. A series of installation pictures and captions for each clamp provides instructions for the repair of all types of pipe leaks.

M. B. Skinner Co.

■

14 Meter Run Catalog

Engineering data relating to meter run designs is contained in a new catalog from Robinson Orifice Fitting Co. Graphs, charts, and curves show recommended orifice fitting installation and piping arrangements. Many standard tables are included.

Robinson Orifice Fitting Co.

■

15 Process Control Bulletin

A new bulletin, F 5633-1, describing the complete line of Wheelco Instruments (Barber-Colman Co.) for industrial process control application is now available. Of special interest is a discussion of the Wheelco electronic link, a simple no-contact linkage between the precision, direct measuring unit and the automatic control and recording system which gives instantaneous control and recording action.

Wheelco Instruments Div.
Barber-Colman Co.

■

16 Spectrometer Catalog

A colorful catalog has just been published by Consolidated Engineering Corp. describing the company's Model 21-610 mass spectrometer, a precision electronic instrument designed to measure continuously the amount of the various constituents in a process stream. The catalog tells how the spectrometer works, describes process monitoring and control, the basic instrument, its accessories, its applications and performance characteristics.

Consolidated Engineering Corp.

■

17 Valve Line Bulletin

Bulletin 195 describes a newly designed forged steel valve line from the Ohio Injector Co. Long-wearing wedges, stronger stem-to-wedge connections and a union bonnet giving increased efficiency have been incorporated into the new valves.

Ohio Injector Co.

■

18 Fitting Catalog

A 304-page general catalog on seamless welding fittings, forged flanges, and forged steel fittings has been released by Ladish Co. The catalog devotes 56 pages to a technical data section and presents up-to-date tables containing the latest provisions of applicable piping codes and standards to assist in solving piping problems.

Ladish Co.

YOU NEED

PROTECTO WRAP...

FOR THE FAST, EASY AND ECONOMICAL COATING OF FIELD JOINTS, GAS SERVICE FITTINGS AND MECHANICAL COUPLINGS

PROTECTO WRAP is a hot applied protective coating in roll form for field joints on mill or yardcoated pipe, fittings, couplings and other metal surfaces exposed to above and below ground corrosion.

PROTECTO WRAP consists of a plasticized coal tar or asphalt enamel, of the types used for pipeline coating, saturated into a glass fabric that acts as a carrier and reinforcement for the enamel. PROTECTO WRAP is interwoven with a paper separator that insures even distribution of the coating as well as easy unwinding, regardless of temperature. The material is used to coat mteal surfaces where the quality of hot applied reinforced bituminous coating is desired.

PROTECTO WRAP is available in 2, 4 and 6 inch widths, fifty feet in length; and in 18 and 24 inch widths, 30 feet in length.

Our sales representatives are available to demonstrate this material and method. Address your orders or inquiries to our nearest sales office or to 2255 South Delaware Street, Denver, Colorado.

1406 JEFFERSON AVENUE, HOUSTON, TEXAS
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P. O. BOX 33, KENILWORTH, NEW JERSEY
ROOM 800, 20 E. JACKSON BLVD., CHICAGO, ILLINOIS

PROTECTO WRAP COMPANY
DENVER, COLORADO

ASSOCIATIONS

Program shaping up for AGA's 36th convention

Authoritative speakers on many subjects of great interest to the entire gas industry are being scheduled for the 36th annual convention of the AGA to be held Oct. 11-13 at Atlantic City. The various section programs are taking final form and outstanding events are being arranged for the general sessions on each of the three mornings of the convention.

Non-business plans include the president's reception, entertainment and ball on Monday evening; a ladies' party and reception on Tuesday afternoon; and a program of excellent entertainment on Tuesday afternoon. General sessions will be held in the Ballroom Auditorium at 10 a.m. each morning. The reception and ball and the entertainment also will be staged at the auditorium.

The operating section will hold afternoon sessions Monday and Tuesday at Trimble hall, Hotel Claridge, which has been designated as headquarters for the section. The program for the meetings will feature a demonstration on remote control of pipelines. Panel discussions on customer service, quality control, and other pertinent topics will be included. Papers on off-shore drilling and safety codes will be presented.

The Hotel Dennis has been designated as headquarters for the residential gas section, but the section will hold its meeting in the ballroom of the Auditorium at 2 p.m. Monday. The program will feature a series of presentations devoted to promotion and sales of residential gas appliances.

The accounting section will meet at the Viking room, Haddon Hall on Monday and Tuesday. The Chalfonte-Haddon hotel is headquarters for the section. The Tuesday session will be a luncheon meeting at the Rutland room in Haddon hall.

The Home Service Breakfast will be held Tuesday morning, Oct. 12, in the American room, Hotel Traymore. The afternoon meeting of the home service committee, featuring the annual roundtable discussions and promotional highlights, will take place Tuesday afternoon at the St. Dennis room, Hotel Dennis.

The general management section, with headquarters at the Chalfonte-Haddon Hall hotel, will sponsor its annual luncheon meeting in the Carolina room, Chalfonte hotel, on Tuesday.

The Shelburne hotel will be headquarters for the industrial and commercial gas section, which plans to hold its annual luncheon in the Rose room of Hotel Traymore at 12:30 on Tuesday. An afternoon meeting will follow.

A general luncheon meeting will be staged at the Auditorium on Wednesday, following the general session.

Lancaster S-7 GROOVE TYPE METAL RIM DIAPHRAGM

Performance advantages of the Lancaster S-7 mean a closer to 100% overall accuracy — and an extra margin of profit. Patented Lancaster features and superior quality construction add up to more years of service in the meter — and another margin of extra profit.

If you are not using the Lancaster S-7 groove type metal rim diaphragm for your small meter repairs and replacements, write for a sample today.

Lancaster METER PARTS CO.

POST OFFICE BOX 378 • LANCASTER, OHIO

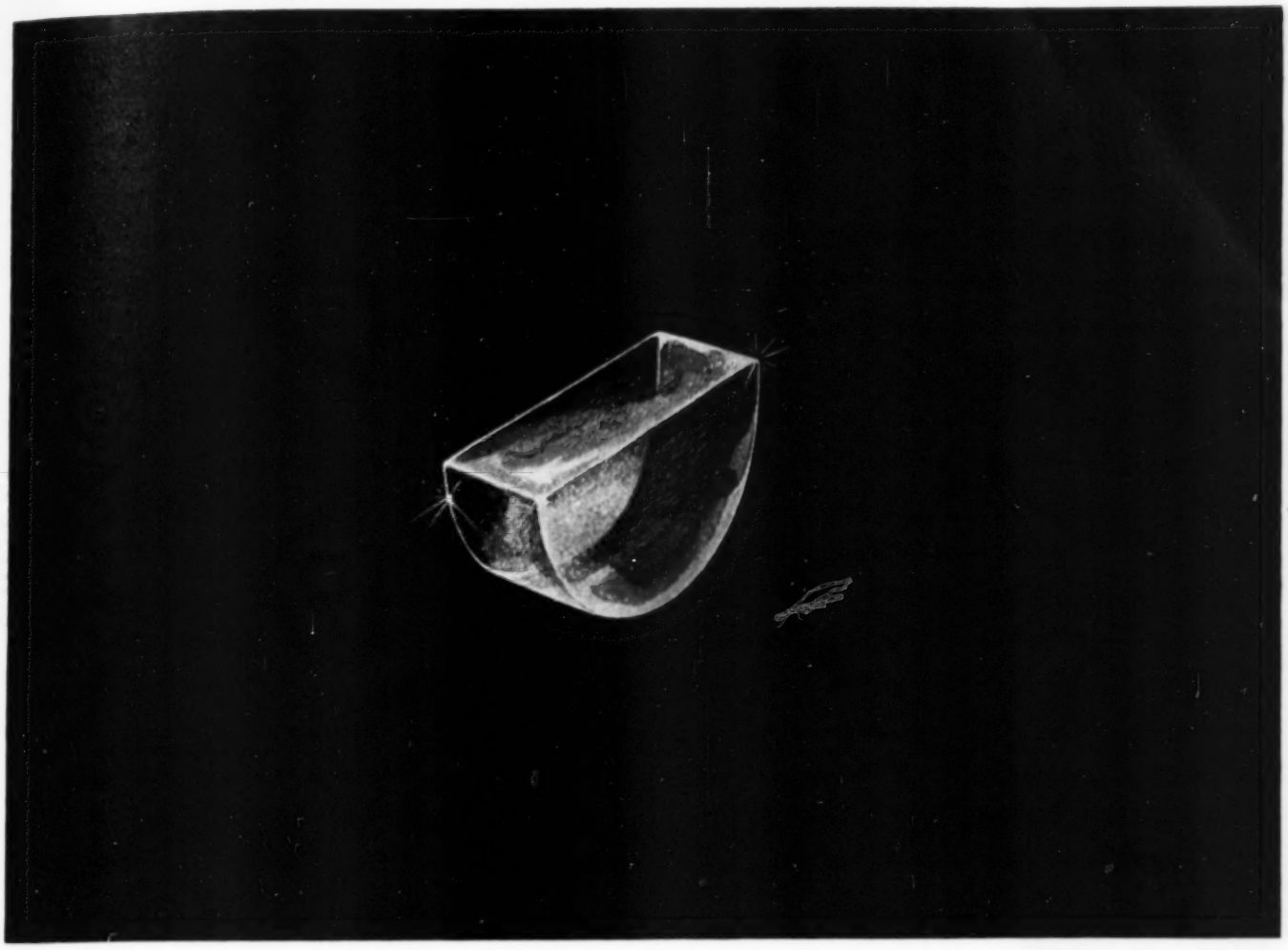
E. D. Sherwin
President

Guy Wadsworth
Vice President

PCGA elects Sherwin at 61st annual convention

Pacific Coast gasmen, meeting this month in Vancouver, B.C., for the 61st annual convention of the Pacific Coast Gas Association, elected Emery D. Sherwin to the presidency of the group, succeeding W. C. Mainwaring of British Columbia Electric. The new president is also president of the San Diego (Calif.) Gas & Electric Co. Guy Wadsworth, vice president and general manager of Southern Counties Gas Co., Los Angeles, was elected vice president, and Harry McGann, of Pacific Gas & Electric Co., San Francisco, continues as treasurer.

Four men earned their way into the '49er Club, which gives recognition to men who

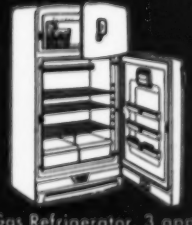


KEYSTONE OF THE *ALL GAS* KITCHEN

This "ice cube" (we call it an IceCircle) is made by the world's only refrigerator that makes ice cubes without trays...and puts them in a basket automatically! A Servel exclusive!

The Servel Gas Automatic Ice-Maker Refrigerator represents the greatest refrigerator advance in 30 years! And it is this very same Servel Gas Refrigerator with its no moving parts freezing system, that is the keystone to the All Gas Kitchen. It represents a steady base gas load every day of the year. Yet it is but one of Servel's gas using products. There's the complete line of automatic gas water heaters and the Servel Wonderair "all-year" gas air conditioner that raises your summer load to a profitable level!

Truly the Servel Gas Refrigerator you sell today will work for you for years...and will pave the way for the use of other gas appliances in the kitchen and in the home!



Gas Refrigerator. 3 appliances in 1...refrigerator, freezer, and automatic ice-maker!

Automatic Gas Water Heater. A quality line second to none in the industry. 20 to 75 gal. cap.

"All-Year" Gas Air Conditioners. One compact unit heats and cools the entire home the year round!

Servel

The name to watch for great advances in REFRIGERATION and AIR CONDITIONING

Servel Inc., Dept. G9, Evansville 20, Indiana
In Canada: Servel (Canada) Ltd.,
548 King St. W., Toronto, Ontario

have done a variety of work for the group, ranging from committee work to conference sponsorship to the more spectacular achievements. The new members this year are Ralph Phillips, San Diego Gas; A. R. Bailey, Coast Counties Gas & Electric; C. R. Renz, Southern California Gas Co.; and C. F. Briscoe, Southern Counties Gas Co.

New England promotion is well coordinated effort

First reports on association-wide activities to promote the use of gas in the New England market, recently released, indicate that NEGA is moving into the situation in a well-coordinated and ambitious manner.

Key point in the effort is the joint action by the various utility companies to take further advantage of the opportunities that the coming of natural gas has opened up.

Two councils, established some months ago by the association president, have reported initial activities. One, the promotional planning council, headed by F. H. Faulstich of Springfield, Mass., has advanced plans for coordinated promotional and advertising activities on a regional basis that will parallel AGA's nationwide effort.

The program was kicked off with a survey of promotional timing schedules of member companies, the results of which showed that existing schedules coincided to a marked degree. The council requested each company to forward one set of advance proofs of all types of advertising and promotional materials to NEGA headquarters, where that company had prepared a complete campaign. The association planned to disseminate copies of the best program materials to the entire company membership. This procedure was to be completed well in advance to enable companies choosing to copy another company's ideas sufficient time to schedule their own programs simultaneously with the archetype.

Companies were scheduled to receive proofs of an entire "Matchless Moderns" campaign by late August for fall use. The package, originated in the Boston merchandising area by the three local utilities—Boston Consolidated, NEGEA, and New England Electric Service's gas division—was based on last year's highly successful theme, with the emphasis on kitchen-heating ranges.

The second council, a service coordinating council chairmanned by Andrew W. Johnston of Boston Consolidated, began working along the lines of securing AGA and GAMA action to standardize terminology for appliance parts and to effect certain appliance construction changes. The council also took steps to set up the machinery for establishing facilities for training appliance service representatives.

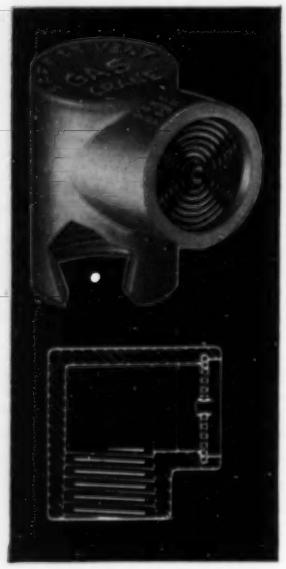
Three-month PEP program launched by AGA

During September, October, and November the AGA will launch the gas industry's most intensive commercial cooking sales campaign. Known as the 1954 PEP program (performance, economy, and profit), the nationwide promotion is designed to solidify recent impressive gains of commercial gas appliances.

Specifically, the program will unite equipment dealers, appliance manufacturers, and gas companies in aggressive efforts to replace obsolete and inefficient cooking units with new automatic gas appliances that show greater production and higher operating efficiency.

Patterned after the highly successful 1953 campaign, the new PEP program meets the request of leading manufacturer and dealer authorities for increased emphasis on replacement sales. To utilities, the campaign offers (1) closer working relationships with equipment dealers, (2) insurance against loss to competition, (3) better equipment on the lines, (4) better trained salesmen, and (5) a higher level of sales activity.

A brochure, which has been mailed to AGA utility and manufacturer members, details the what, when, where, who, and why of the campaign together with step-by-step details of procedure. Contents have been prepared so that individual companies can



New CRANE ¾-inch Safety Vent Elbow with non-clogging screen

Here's a basic improvement in gas vent elbows. A flexible stainless steel coil spring takes the place of the old bar grate or rigid screen that clogged so easily. In normal, or closed position, the space between the windings of the coil spring is small enough to keep out insects, dirt, etc. But gas pressure from behind easily flexes the spring outward, enlarging the space between coils for full-open venting of gas and the expulsion of foreign matter.

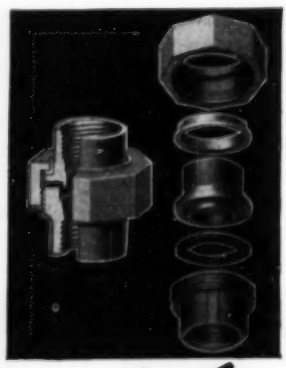
Durable, dependable—die cast of zinc alloy with integrally cast cross bar to prevent the coil spring from being jammed back into the fitting. *Thousands already in service.*

Check your Crane Representative on both these new items!

New CRANE Insulated Union

Gives Cathodic protection at meters

Install this new insulated union at the gas meter for cathodic protection against galvanic corrosion. Special gasket and washer with high dielectric strength effectively break the electric path. Regular ¼-inch size in Crane malleable iron.



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follow the program either wholly or in part, and can tailor their own campaigns to their individual budgets.

Iowa State will be scene of 31st Midwest gas school

The 31st Midwest gas school and conference will get under way on Wednesday, Sept. 8 at Iowa State College in Ames.

Conducted by the Mid-West Gas Association and the engineering extension service of the college, the three-day course will offer a wide range of subjects, including demonstrations of trenching machinery, backfillers, tampers, air compressors, backhoes, concrete saws, pipe saws, and similar distribution construction machinery.

The servicemen's school will cover fundamentals of electricity as applied to gas appliance controls, servicing of such controls, test equipment and electrical line diagrams. Vern Pearson, supervisor of training, and T. C. Carson, utilization engineer, both of Minneapolis (Minn.) Gas Co., will conduct instruction in the school.

Additional subjects include safety, corrosion, domestic heating controls, the design and application of rotary positive displacement meters, meter standardization for domestic use, proving positive displacement meters, plastic pipe, synthetic diaphragms, renewing old gas services, outdoor meter sets, gas dispatching, conversion problems. Discussions will also be held on testing orifice meters, large capacity meters, improving gas meter accuracies, and the use of test meters in solving service problems.

How PR can solve industry problems highlight meeting

Gas industry problems were given a good airing and the public relations role in solving these problems was thoroughly discussed at the gas industry public relations conference in Omaha, July 26.

The conference, with a registration of nearly 250, was the largest regional gas industry meeting ever held.

Three regional gas associations—Midwest Gas, Blue Flame Gas, and Nebraska LP-Gas Dealers—cooperated with the national Independent Natural Gas Association of America, Gas Appliance Manufacturers Association, and the American Gas Association in staging the one-day meeting.

M. B. Cunningham, president of the Midwest Gas Association and superintendent of gas distribution for the Iowa Power & Light Co., Des Moines, was chairman.

In the opening address, W. E. Wilson, chairman of INGAA's public information program advisory committee and director of public relations for the United Gas Corp., Shreveport, took issue with those who feel the best interests of the public and the industry would be served by government regulation of natural gas production.

"It is my deliberate and sincere judgment

backfill problem

How Else Could You Do It?

IN JEFFERSONVILLE, INDIANA the E. H. Hughes Construction Co. had dug a 3′ wide trench for a lateral sewerline to a depth of 12′—in some places 15′—to tie in to an existing sewer main. This spoilbank along the edge of a built up residential street (hidden by spoilbank in photo) presented a real backfilling problem. Because the street had to be kept open to traffic and dust raising held to the minimum, the huge spoilbank could not be filled from the street side.

Hughes solved the backfilling problem—and at the same time compacted the filled trench—with a one-man-operated machine, the Cleveland Model 80-W. Needing minimum working space, easily able to pass under tree branches and clear all obstructions, the compact 80-W worked off the street, travelling parallel to the trench on the opposite side from the spoilbank. The street was kept open and the dust problem minimized.

The one-man 80-W did the complete filling and compacting job simultaneously as it travelled, cleaned up and left the job ready for immediate repaving. Its low ground pressure and perfect balance on wide full crawlers practically eliminated damage to the lawns, sidewalks and driveways it crossed.

Because of its unique versatility the Cleveland 80-W is saving owners time and money on a wide variety of pipelaying, trench filling and trench compaction jobs.

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that nothing could be farther from the actual truth," Wilson said. "The simple fact is . . . regulation of natural gas production in lines with the accepted concepts of utility control will strangle and stifle the future discovery of gas reserves essential to meet consumer needs.

". . . It is the duty and responsibility of everyone in our industry to use every reasonable, legitimate means available to get that fact across to our customers, employees, business associates, and to the leaders in every category in the communities in which we do business."

Touching on his work with INGAA's public information program, Mr. Wilson asserted, "Those responsible for its creation have kept one cardinal precept always before them. That precept is: No public information program can be a success unless it is concerned with and in the public interest."

He described the INGAA program as an integrated approach embracing all segments of the industry.

"Participants in the INGAA program are now making their voices heard in all these segments; among large companies and small, and in many sections of the country," he asserted. "Seventy-five gas companies and state and regional gas trade bodies in 25 states and Canada are using INGAA information materials produced in the past 10 months."

Remick McDowell, chairman of AGA's public relations coordinating committee and vice president in charge of public relations and finance, Peoples Gas Light & Coke Co., Chicago, stressed that "a service industry such as ours can never take its publics for granted."

"If we are to continue to move ahead, we must tell our tale in bold, clear and forthright terms," he added.

Mr. McDowell also touched on recent action by AGA in coordinating public relations efforts. "Recognizing that the overall public relations approach should be industry-wide, and not insular in scope, the association has appointed a committee of five gas industry executives to work toward coordination of the association's public relations activities with similar work of other significant national organizations within the industry."

"There will always be occasions," Morris E. Jacobs, of Bazell & Jacobs Inc., said, "for conflicts of interests (between producer, pipeliner, and distributor), but no occasion should be permitted to arise when any segment of the industry permits any group of circumstances to overwhelm it to the point where actions are taken which, in the ultimate, harm the whole industry."

Association notes

Six symposia of technical papers and two discussion programs have been scheduled for the Oct. 14-15 meeting in Dallas of the South Central region of the National Association of Corrosion Engineers.

Symposia will be presented on cathodic protection, protective coatings, inhibitors, processing plant corrosion problems, pipeline corrosion, and oil and gas production. Discussion programs will consist of a question-and-answer audience participation session and a general roundtable on oil and gas transportation.

A symposium on methods for testing liquefied petroleum gases will be held Sept. 27-28 at the Statler hotel in St. Louis. The symposium is jointly sponsored by ASTM Committee D-2 on petroleum products, ASTM Committee D-3 on gaseous fuels, the Natural Gasoline Association of America, and the California Natural Gasoline Association. In addition to two full days of technical papers, there will be a display of specialized LPG testing equipment.

David F. Grozier, formerly publicity supervisor of The Brooklyn (N. Y.) Union Gas Co., has joined the public information bureau of the American Gas Association, replacing Sidney Feldman, whose resignation became effective July 1. Mr. Grozier's gas industry experience dates from 1943, when he became associated with the Southern California Gas Co. He moved to New York and Brooklyn Union in 1949.

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. . . a 16 mm. color-sound movie that shows the ease, economy, and effectiveness of CARBOSEAL anti-leak — the answer to leakage from jute-packed bell joints in dry-gas systems. It will be sent to you without charge — on request.

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William L. Hess, vice president of Anesite Co., Chicago, and president of Plastic Pipe & Tube Corp., Santa Barbara, Calif., was unanimously re-elected chairman of the Thermoplastic Pipe division of the Society of the Plastics Industry at a recent meeting of the group's executive committee.

The 1954 edition of the AGA's "Special Features of Current Gas Ranges," a compact chart of recent gas range developments produced by 43 manufacturers, has been released. Special features are grouped into eight categories: type, size, color other than white, top section, broiler section, oven section, recessed range sections, and additional features.

A. C. Lyles, senior gas engineer of the General Petroleum Corp. officially assumed the duties of president of the California Natural Gasoline Association at the annual meeting of the board of directors last month. P. E. Beckman, Pacific Gas & Electric Co., is a new director. Serving as directors until 1955 are M. L. Fort and R. W. Todd of Pacific Lighting Gas Supply Co., and Grove Lawrence, Southern California Gas Co.

Five new members have joined the Gas Appliance Manufacturers Association. They are :Adams Manufacturing Corp., Los Angeles; McIntyre Engineering Co. Inc., South San Francisco; Westcott-Alexander Inc., Madison, N. J., Ko-Z-Aire Products Inc., Baltimore, Md.; and Switson Industries Ltd., Welland, Ont., Canada.

Elmer R. Kaiser has been appointed to the post of director of research for the American Society of Heating & Ventilating Engineers. He will headquarter at the Society Research Laboratory in Cleveland. For 20 years Mr. Kaiser has served on the staff of the Battelle Memorial Institute.

Correction

An error appeared in the third paragraph of the article on "Efficiencies and Recovery Rates Established on Competitive Water Heater Tests," by Prof. Eugene F. Hebrank, which appeared on pages 53-54 of the August issue of GAS.

In the paragraph detailing the standby Btu consumption, the sentence that reads "Approximately five times as much heat is required by the gas heaters as is required by the electric heaters to maintain a tank full of hot water" should read "Approximately five times as much heat *per gallon of stored water* is required by the gas heaters as is required by the electric heaters . . ."

The real comparison of standby energy uses is 23,000 Btu per 24-hr day for the gas water heaters vs. 9100 Btu per 24-hr day for the electric water heaters.

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...with the guaranteed trouble-free housing!

Only the RIDGID has a world-wide rep as the finest pipe wrench made. Only RIDGID has earned and maintains this rep by building toughness and smart performance into these overwhelmingly popular wrenches, checking them part by part and *hard work testing every last one* before shipment. When you buy a RIDGID, you know the housing won't break, the jaws won't slip or lock, the adjusting nut spins easily to all sizes, 6" to 60". Always most for your money—ask your Supply House.

Have you tried the new RIDGID Spud Wrench?

Deep narrow jaws for close work—break-proof housing — famous RIDGID jaw suspension — comfort-grip I-beam handle. Ask your Supply House.

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Current Reading

OIL FOR TODAY . . .AND FOR TOMORROW—Published by the Interstate Oil Compact Commission, this booklet deals with the origin, production, conservation, and importance of oil and gas and presents in condensed form important aspects of the production and conservation problem in a way that laymen, such as legislators and students, can easily understand.

Single copies of the 84-page, illustrated booklet are available without cost from IOCC Headquarters Office, Box 3127, Oklahoma City 5. More than one copy will be furnished at the actual printing cost of 30 cents each.

IN-PLANE BENDNG PROPERTIES OF WELDING ELBOWS—This paper was presented at the annual meeting of the ASME. It presents results of strain gauge investigations conducted on relatively heavy wall WeldElls having a ratio of bend radius to nominal pipe sizes of 1½:1. Also, several WeldElls having a ratio bend radius of nominal pipe size of 1:1 were tested. A comparison is made of the results against theory. Design factors for WeldElls are established and tabulated.

The purpose of the paper is to provide design engineers with accurate, experimentally derived flexibility and stress intensification factors applicable to welding elbows commonly used in high pressure steam, oil refinery, and gas compressor station piping systems. It is aimed at filling a now existing gap in the practical design information available for a class of fitting having wide industrial use.

Reprints are available (as Bulletin 534) from Taylor Forge & Pipe Works, Box 485, Chicago 90.

DRYERS AND DRYING—Information Letter No. 61 issued by the AGA industrial processing committee. Drying is used in many industrial processes for which gas is the natural medium to supply the heat required. The committee believes that the information in this letter will provide industrial gasmen with knowledge necessary to figure the gas loads involved without attempting to create design engineers.

AMERICAN STANDARDS FOR 1953—Among the new ASA standards are the following: Specifications for Cast Iron Pit Cast Pipe for Gas (A21.3-1953); Specifications for Cast Iron Pipe Centrifugally Cast in Metal Molds for Gas (A21.7-1953); Specifications for Cast Iron Pipe Centrifugally Cast in Sand-Lined Molds for Gas (A21.9-1953); and Specifications for a Mechanical Joint for Cast Iron Pressure Pipe and Fittings (A21.11-1953).

Price lists are available from the ASA, 70 E. 45th St., New York 17.

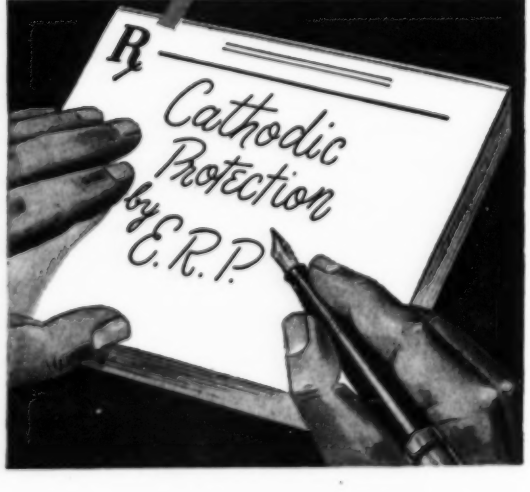
LABORATORY INSTRUMENTS; THEIR DESIGN AND APPLICATION—By A. Elliott and J. Home Dickson. This book serves as a complete and practical guide to the research worker who in present-day laboratories is called upon to devise and supervise the construction of specialized instruments for specialized work.

The essentials of good design are taken up in the early chapters with a detailed analysis of the properties of materials and their treatment and use in the construction of instruments. The practical limitations of workshop equipment and practice are also discussed as they relate to instrument construction.

Published by the Chemical Publishing Co. Inc., New York. Price $7.50.

TOXICITY OF INDUSTRIAL ORGANIC SOLVENTS—By E. Browning. The research engineer and the operating manager alike will find considerable of value in this revised listing of solvents used in industrial applications. It summarized from widely scattered sources the available information about the effects on animals and man of the various solvents that are used in industry. As such it serves as a guide and reference

Rx FOR CORROSION...



You don't need a specialist to *recognize* Corrosion. But you do need one to treat it successfully. The skill required to achieve complete corrosion control comes only from the knowledge and experience gained through years of practical application.

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manual for the diagnosis and treatment of acute and chronic poisoning of persons who use organic solvents.

The principal aim of the collecting and publication of these data is the avoidance of poisoning from the use of solvents discussed and to facilitate the diagnosis of poisoning and treatment of those exposed to the effects of the solvent.

Published by Chemical Publishing Co. Inc., New York. Price: $8.

SHORTER SIX-FIGURE MATHEMATICAL TABLES—This book by L. J. Comrie contains a collection of mathematical tables used in general purpose computation requiring more than four-figure accuracy. It is compiled from a two-volume set of mathematical tables that totalled 1200 pages. Many of the pages have been taken from one or the other of the parent volumes while others have been reset with wider interval of argument.

It provides the engineer with a readily available compilation of all the mathematical tables required in his normal computation.

The tables include: Logarithms of Trigonometrical Functions of Angles in Degrees, Minutes and Seconds; Trigonometrical Functions of Angles in Degrees, Minutes and Seconds; Circular Functions, or Trigonometrical Functions with the Argument in Radians; Exponential and Hyperbolic Functions. Included also are a group of miscellaneous tables, conversion factors and physical and other constants.

Published by Chemical Publishing Co. Inc., New York. Price $6.50.

Loyal to gas

Milwaukee Gas Co.'s employees loyalty to gas was revealed recently when a company survey showed that approximately 40% of the employees have all-gas appliances in their homes.

Of the 852 out of 1485 replying to the question, "Of the following appliances in your home which are gas or electric: ranges, water heaters, refrigerators, clothes dryers, incinerators?", 345 had all gas appliances and 437 households had all but one appliance on gas.

Attesting to the choice of gas solely on merit are these comments:

"We honestly believe gas appliances are far superior in comparing the efficiency of our appliances to those of our friends . . . This is especially true in regard to cooking, water heating and clothes drying."

"Would not want to be without my gas dryer; it takes less time than any other type of dryer and have proved same with friends."

"All gas—I sure am getting my money's worth."

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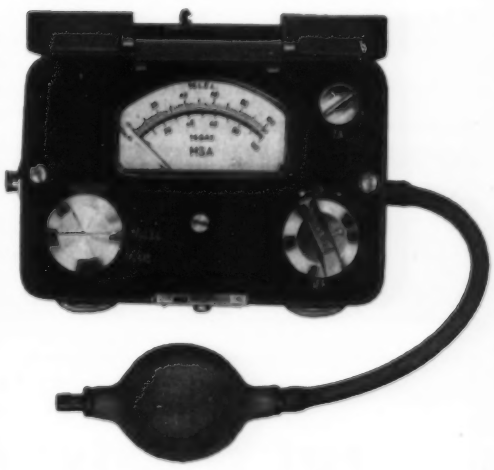
% GAS
This setting gives you 0 to 100% of lower explosive limit
. . TURN THE SWITCH
% L.E.L.
% GAS
This setting gives you 0 to 100% by volume of combustible gas

This New Simplicity —New Versatility in ONE instrument ...the M·S·A GASCOPE

The illustration above shows you how, with the simple turn of one selector switch, the M.S.A. Gascope gives you both high sensitivity for the detection of low gas concentrations, and immediate, quantitative response for tracing higher concentrations of gas to its source. Separate scales for each range are calibrated on the fan-shaped meter in the center of the instrument. Each scale is divided by 50 graduations to permit accurate, fast readings.

This dual-range, direct reading instrument is the modern answer to fast, dependable detection and location of gas concentrations over the entire range from 0 to 100% by volume. Write for details, or ask for a demonstration. Your request will be handled promptly.



The Gascope is light, comfortable, and demands no special skill to operate. A variety of accessories are available to meet all sampling conditions.

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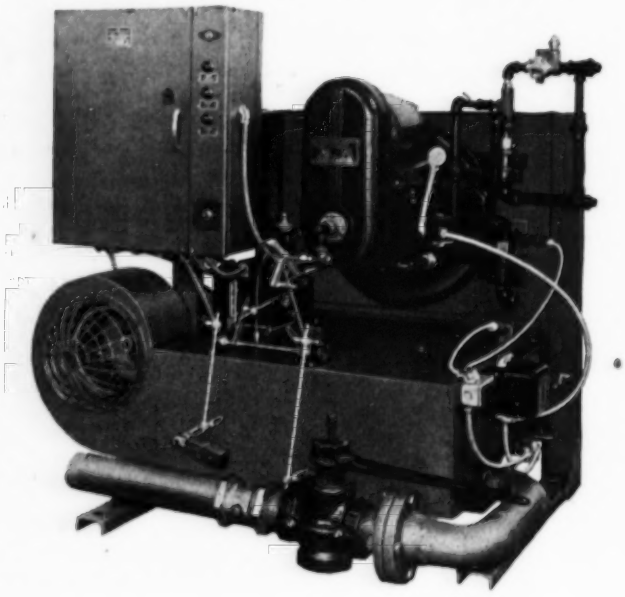

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- Sizes from 75 to 300 horsepower.
- Minimum gas pressure requirements.
- Low installation costs.
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- Utilizes all grades of fuel oil.
- Extremely low noise level.
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- Simpler changeover than ever before.
- One hundred per cent forced draft.
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These and many other outstanding features combine to provide the same dependable high quality performance as the WEBSTER DYNETIC gas burner. Neither fuel must suffer if the WEBSTER ROTONETIC is used. With integral pumps, integral oil preheaters for heavy oils, patented oil burner "flame-shaping" vanes, and full modulating or optional high-low control, the WEBSTER ROTONETIC is designed to provide long lasting customer satisfaction the year around.

It is furnished with a precast refractory front as an integral part of the burner assembly. The installer need only finish the furnace wall on each side and above the burner.

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CALENDAR

September

8..NEGA Joint Customer Service Managers Group and Manufacturer - Distributor Division — Wachusett Country Club, West Boylston, Mass.

8-10..31st Mid-West Gas School and Conference, Iowa State College — Hotel Sheldon-Munn, Ames, Iowa.

8-10..Pacific Coast Gas Assn. — Vancouver, British Columbia.

10..New Jersey Gas Association —Hotel Monmouth, Spring Lake, N. J.

10..SGA Compressor Station Operation Conference — Jung Hotel, New Orleans.

13..SGA Distribution Operating Conference — Henry Grady Hotel, Atlanta, Ga.

13-14..Independent Natural Gas Association of America Annual Meeting — Roosevelt Hotel, New Orleans.

15-17..AGA Accident Prevention Convention — Bond Hotel, Hartford, Conn.

17..NEGA Industrial Division — Wachusett Country Club, West Boylston, Mass.

17..SGA Distribution Operating Conference — Rice Hotel, Houston.

17..NGAA Oklahoma Regional Meeting — Skirvin Hotel, Oklahoma City.

17-18..Maryland Utilities Assn., Fall Conference — Virginia Beach, Va.

24..Oklahoma Utilities Association Gas Division Meeting —Biltmore Hotel, Oklahoma City.

27-29..Electrical Conference of Petroleum Industry (Petroleum Industry Committee, AIEE) —Mayo Hotel, Tulsa.

28-29..Texas Mid-Continent Oil & Gas Assn. — Baker Hotel, Dallas.

30..SGA Transmission Management Conference — Shamrock Hotel, Houston.

October

7-8..California Natural Gasoline Assn. Annual Fall Meeting. Ambassador Hotel, Los Angeles.

10-13..Controllers Institute of America — Edgewater Beach Hotel, Chicago.

11-13..AGA Annual Convention — Atlantic City, N. J.

18-22..National Safety Council — Chicago.

29..NGAA Southern Regional Meeting—Blackstone Hotel, Tyler, Texas.

November

1-5..National Metal Exposition—Chicago, Ill.

4..NEGA Operating Division — Hotel Statler, Hartford, Conn.

8-11..American Petroleum Institute—Conrad Hilton Hotel, Chicago.

15-17..American Standards Association—Hotel Roosevelt, New York.

17..NEGA Safety Conference — Hotel Statler, Boston.

17-19..Southeastern Gas Association —Sir Walter Hotel, Raleigh, N. C.

17-19..Wisconsin Utilities Association, Electric & Gas Section, Technical & Sales & Service Divisions — Hotel Schroeder, Milwaukee.

28-3..American Society of Mechanical Engineers — Statler Hotel, New York.

December

3..Panhandle Plains Regional Meeting NGAA — Herring Hotel, Amarillo, Texas.

7..NEGA Appliance Servicing Conference — Hotel Statler, Boston.

8-10..Eastern Computers Conference (AIEE, IRE, ACM) — Bellevue-Stratford Hotel, Philadelphia.

1955

January

18..NEGA Operating Division—Hotel Statler, Boston.

March

7-9..Mid-West Gas Association—St. Paul Hotel, St. Paul, Minn.

7-11..National Assqciation of Corrosion Engineers — Palmer House, Chicago.

24-25..AGA Gas Supply, Transmission & Storage Conference—William Penn Hotel, Pittsburgh.

24-25..NEGA Annual Meeting — Hotel Statler, Boston.

24-25..Oklahoma Utilities Association Convention — Mayo Hotel, Tulsa.

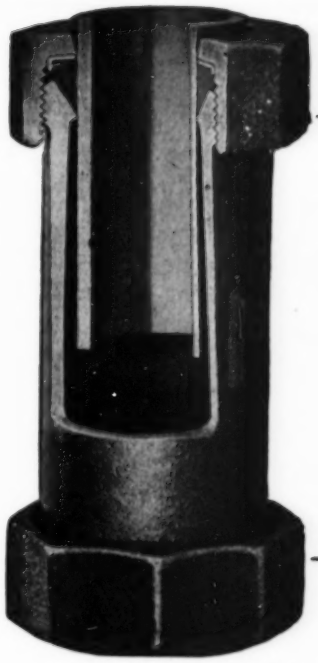
April

12-14..AGA Sales Conference on Industrial & Commercial Gas —Hotel Statler, Boston.

12-15..AGA Distribution, Motor Vehicles & Corrosion Conference — Netherland Plaza, Cincinnati.

19-21..Southwestern Gas Measurement Short Course—University of Oklahoma, Norman.

25-27..Mid-West Regional Gas Sales Conference—Edgewater Beach Hotel, Chicago.



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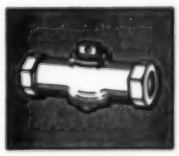
for maximum deflection, ease of "stabbing," complete confinement of the rubber!

So close are "Normac" rubbers confined at the gasket tip that possibility of flow is reduced almost to "nil." These couplings, sleeves and fittings . . . approved by gas utility men across the country for their time-saving features, ease of handling and dependable service . . . are available in a complete range of sizes. Made from air furnace malleable iron they provide greater wall thickness than pipe on which used.

NORMAC COUPLINGS are made with 5" centers in all sizes. NORMAC SLEEVES are identical in design except that they are made with 10" centers. Nuts and gaskets are interchangeable.

Compression-End Service "Tee"—First fitting of this type ever produced with full coupling depth and special threads on male end to prevent dropping into old hand taps when used to replace standard threaded fittings.

Compression-End Service "Ell" — Extra depth makes it possible to "stab" pipe into stops and without measuring, pull back a safe distance to allow ultimate deflection eliminating possibility of strain against tap in main.



Compression-End Iron Body Brass Core Service Stopcocks—End the necessity of threading on the job plus the elimination of the threads themselves—combining all the advantages of NORMAC COUPLINGS and the best in stopcock design. 2½" coupling depth on each end.

Normac Brass Fittings Developed in 1939 for Use with Copper Tubing—Our complete line of brass fittings can be used either on new installations or where copper is run through old steel pipe in large or small openings. The center to end dimensions of NORMAC TEES correspond with old malleable iron fittings. This feature is extremely important in the use of these fittings in one foot openings where the tubing must line up with the steel which has been removed.

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• Sizes — ½" thru 4" inclusive • Pressure Rating —300 #W.O.G. • Insulate Domestic meter loops • Insulate well flowlines • Economical in price • Available from stock

All Threads Metal to Metal — No Plastic Threads To Strip Out

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Engineer — must have 5 to 10 years experience in gas distribution system design work. Engineering degree required. Pacific Northwest Manufactured Gas Company preparing for conversion to natural gas. Start $5000 to $6000 per year, ample opportunity to advance. Give full details as to education, experience, marital and military status. Write Box 95.

Application by letter only. Send details to: **Gas** 198 SO. ALVARADO STREET LOS ANGELES 57, CALIFORNIA

NEWS

Oklahoma companies announce merger plans

Agreement on a contract for the merger of Oklahoma Natural Gas Co. and Consolidated Gas Utilities Corp. under the name of the former was announced recently by the presidents of the two companies.

The merger agreement provides that stockholders of Consolidated will receive eight-tenths of a share of common stock in Oklahoma Natural for each share of common stock held in Consolidated. Under applicable corporate law, at least two-thirds of the stockholders of each company must approve the transaction.

Certain investigations and contingencies which each of the companies has placed in the contract must be fulfilled before the deal is closed. These include examination of each company by the other and the review of the estimates of gas reserves, the property, plants and equipment accounts, and the position of the company under various governmental authorities. The entire transaction must be completed on or before Jan. 1, 1955.

The firms have facilities already interconnected at many points, and the merger is deemed by managements of both to be in the best interests of the consumers and stockholders, the statement said. Greater efficiencies in operation and continuity of service should result, the officials said.

$3.5 million for Toronto gas conversion

Consumers' Gas Co. of Toronto plans to bear the expenses of a $3.5 million program that will convert every piece of gas equipment in the city for natural gas.

The natural gas, being brought to Toronto by a 105-mile, 20-in. gas main from the Niagara frontier, will cost one-third less to the householder who uses gas for heating, cooking, and refrigeration.

The actual switch-over will start early in November. By that time the gas main from Niagara, 17 miles of which are now finished, will be completed, and the Metropolitan area will be divided into 29 "gas-tight" segments, each of which is independent of all the others.

The job of converting a segment of the city will take three days. On the first day all gas furnaces will be switched over so that no house will get cold. Also, industrial equipment will be carefully inspected and converted on the first day so that no plant shut-downs are required. No one will wait for more than three days.

The gas company officials plan a city-wide advertising campaign in newspapers and by other means to make sure that everyone is at home for the conversion process.

Altogether 170,000 gas consumers in the Toronto area will have their equipment con-

verted and tested during the 15-week period. The contractor for the job is Conversion and Surveys Inc., of New York, a firm which has already converted gas supplies in 45 major cities. The work in Toronto will be done by a labor force predominantly Canadian with a few key Americans.

Robertshaw-Fulton Ltd. acquires Toronto plant

Recently acquired on a long term lease by Robertshaw-Fulton Controls Ltd. is a modern manufacturing plant in the Toronto (Can.) area. Operations scheduled to begin late this summer will include manufacture and assembly of thermostatic controls for kitchen ranges, water heaters, and space heaters. The decision to undertake manufacture of certain of the products in Canada was dictated by the expanding needs of Canadian industry.

The modern, one-story plant building contains 30,000 sq ft of floor space, and there is sufficient additional land to permit doubling the present size if necessary.

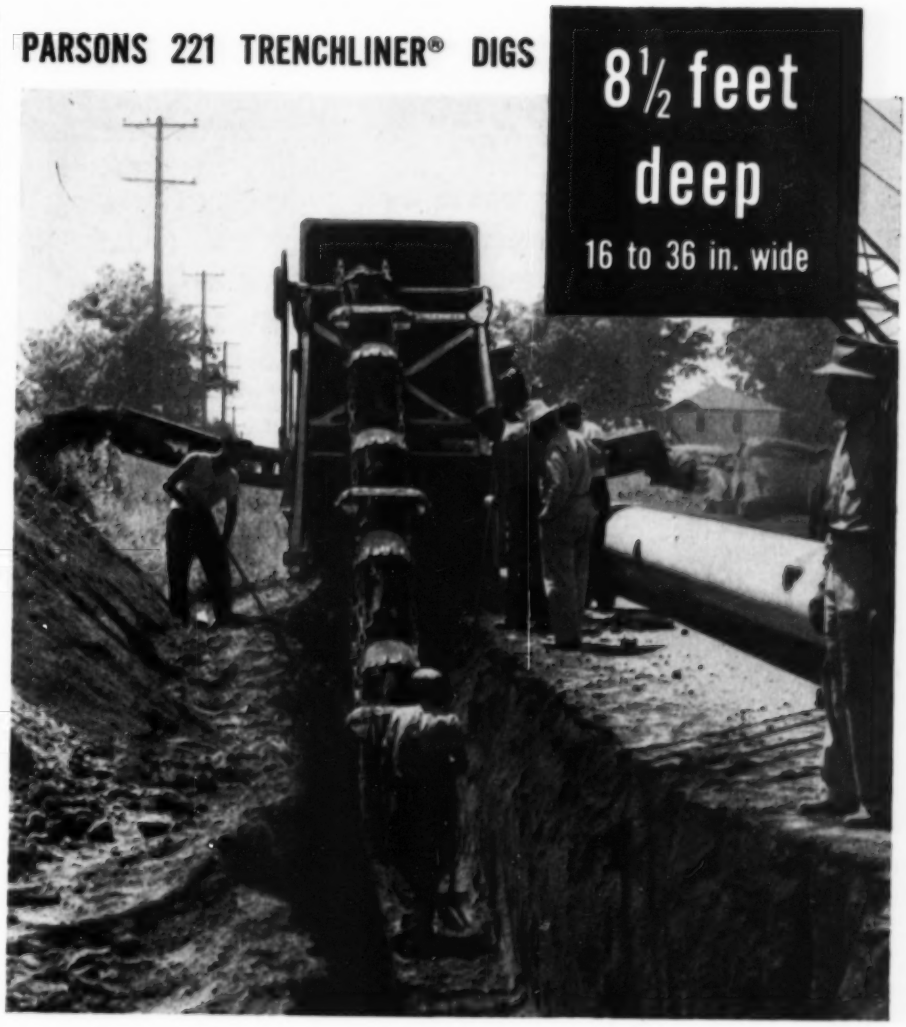
New impact machine tests burner valves

An impact testing machine devised by the AGA Laboratories checks the strength of gas range top burner valves and manual gas valves used with gas appliances. The machine was developed as a routine testing instrument to assure conformance of gas valves with the revised strength provisions specified by the listing requirements for gas valves to become effective Jan. 1, 1955.

Under these requirements, gas range top burner valves are required to withstand an impact of 2-ft-lb at the outlet end of the completely assembled valve without exhibiting leakage or breakage. When considering the location of top burner valves on gas ranges, this impact test is believed adequate as a

AGA Lab's impact-testing machine.

PARSONS 221 TRENCHLINER® DIGS



Parsons 221 Trenchliner combines big work capacity with extreme flexibility . . . digs from 6½ in. to 13-¾ ft. of trench per minute . . . 16 to 36 in. wide, up to 8½ ft. deep. Power-shift spoil conveyor dodges poles and other side obstructions without swerving from grade line . . . shifts completely through machine in less than 1 minute. Belt direction is instantly reversible to dump right or left.

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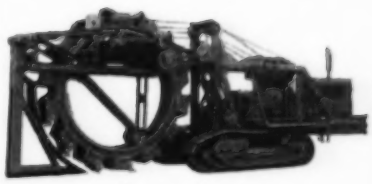
To learn more about what this heavy-duty 221 Trenchliner can do for you, contact your Parsons distributor, or write us. This same type machine is also available in 2 larger sizes, with cutting widths up to 6 feet, and depths to 17 feet, for your biggest jobs.



Parsons wheel-type Trenchliners dig 13 to 31 inches wide, up to 6 feet deep . . . are available in 2 models: 202 (shown) for drainage and utility trenches, Model 215 for cross-country pipelines.

Parsons rubber-tired Trenchmobile® drives job-to-job over highways or through city traffic at 12.6 m.p.h. road speeds . . . digs service connections, main line extensions 8 to 16 in. wide, in depths to 5 feet.

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STREET .....

CITY ..... STATE .....

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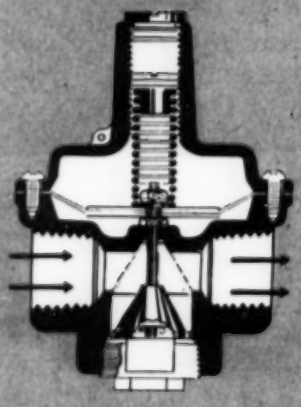

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means to check whether or not the valve will be damaged in the event the housewife should accidently drop a burner and strike the valve during a burner cleaning operation or by other means.

Manual gas valves, except hose end types and those having outlets designed for orifice fittings, however, are required to withstand higher impacts without cracking or breakage. A 20-ft-lb impact will be applied to valves ½-in. nominal pipe size and larger. Gas valves of ¼- and ⅜-in. nominal pipe sizes are given impacts of 10 and 15-ft-lb, respectively.

More gas service for 104 cities

According to the 1954 supplement to the "Natural Gas Construction Data" studies, published by GAMA, 104 cities of more than 50,000 population will receive new or additional natural gas service in the near future. This is due in large part to approval by the FPC during the past year of more than 6000 miles of pipeline construction. Applications currently before the FPC will involve an additional 10,264 miles of pipeline construction which is expected to cost more than $3.5 billion.

The primary purpose of the GAMA study was to provide banks, insurance companies, investment houses, and other financial organizations with detailed information about the spectacular expansion of the natural gas industry. Besides listing the 104 cities mentioned above, it provides the names and addresses of the pipeline and operating utility companies participating in recent new construction, and details the mileage, cost, line sizes, estimated steel line pipe tonnage, compressor horsepower, and other information useful to the industry.

FCDA outlines atomic attack measures

In the event of enemy air attack by atomic or hydrogen bombs, key civil defense installations such as hospitals and mass care centers may have to convert appliances quickly to use liquefied petroleum gas, reports the Federal Civil Defense Administration. It recommends that advance plans for such conversion provide for reports by L. P. gas distributors to civil defense officials showing inventories of equipment and location and capacity of storage tanks in the area.

In a new bulletin, "Restoration of Gas Facilities in Civil Defense Emergencies," the FCDA suggests measures to be taken by gas company officials responsible for their facilities' civil defense emergency operations. Plans are prescribed for the protection of plant personnel and equipment, as well as for speeding up post-disaster restoration of normal gas services to homes and industrial plants.

Gas utility companies should establish a

reserve of materials and supplies for emergency repairs, procuring critical items immediately. Setting up of storage yards outside critical target cities is also advocated.

An important factor in planning is the preparation and frequent dissemination to gas users, with bills or by similar means, of instructions for measures to take in event of attack.

As in other industrial concerns, a gas utility's civil defense coordinator is responsible for the overall civil defense program in the plant. He coordinates his planning with a company representative on the staff of the local chief of civil defense engineering services. The latter is responsible to the local civil defense director.

Plans for maintaining an emergency gas supply and rapid restoration of service should be consistent with the individual facility's self-protection program for its personnel, equipment, and buildings.

FCDA urges that each gas utility, upon completion of its civil defense emergency restoration plan, conduct a field exercise with local civil defense services to determine the plan's adequacy.

Utilities seek control of gas company

Recent merger and acquisition developments include the attempts of the two New York City public utility companies to purchase control of the New York and Richmond Gas Co. Hearings were to be held before the New York Public Service Commissioner on petitions of the two utilities to acquire control of the company, supplying Staten Island with natural gas.

Brooklyn Union Gas Co. had asked the PSC for permission to buy 14,996 common shares of N.Y.&R. stock for $1,850,000, or to issue 58,000 shares of Brooklyn Union common to be exchanged for the 14,996 common of the Staten Island utility. Price would be close to $123 a share.

Kings County Lighting Co. had petitioned the commission for permission to acquire common and voting preferred of N. Y. and Richmond sufficient to give it control. Price offered for the common is $123 a share and for the preferred Kings County would pay the call price of 107½.

TV show features appliance controls

Automatic controls that govern home appliances and make a housewife's job easier were the subject of a recent "Success Story" on KTTV, Channel 11, Los Angeles.

General Controls Co., subject of the original "Success Story" telecast three and one-half years ago, again was visited by the Richfield Oil Corp. weekly show. Site of the program was the Burbank plant.

An actual kitchen was constructed in the plant to show how home appliances use automatic controls to solve such problems as

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Cameras from a Los Angeles television station record operations at General Controls Co. for a "Success Story" telecast. This was the second time around for the company, which was the subject of the original show more than three years ago.

leaky gas, maintaining even oven temperatures, and sufficient supply of hot water. It all points up the fact that housewives today can devote more time to other duties since industry has relieved them of most of the previously manual chores in the kitchen.

Products shown on the show were various types of automatic controls made by General Controls for a great variety of home appliances.

Flow Measurement Co. names Cottrell president

J. L. Cottrell, associated with the Rockwell Manufacturing Co. for more than 20 years, recently resigned his position as sales manager of the Instrument division to become president of Flow Measurement Co. Inc., Tulsa. The new firm will do gas measurement consulting and will be factory representatives for metering and regulating equipment, with offices in the Daniel building.

The firm represents the Chaplin-Fulton Manufacturing Co., Pittsburgh, in the mid-continent area, handling its gas regulators, safety valves, and other products. Other companies represented by Flow Measurement are American Recording Chart Co., Los Angeles, the Weksler Thermometer Corp. of New York, and the Moorlane Co. of Tulsa.

Shipments of gas heat units up 5% in first 6 months

Shipments of gas-operated central heating equipment during the first half of the year exceeded those for the same period of 1953 by 5.6%, according to GAMA figures.

It was reported that 346,500 gas-fired furnaces, boilers and conversion burners were shipped during the first half of 1954, compared with 328,200 units during the same months last year.

Gas furnace shipments were highest with 240,600 units, a 10.3% increase over last year's 218,100. Gas boilers scored a 1.2% gain with 26,200 units this half-year against 25,900 last year. Gas conversion burner shipments totaled 79,700 units as compared with last year's 84,200, a 5.3% decrease.

During June furnace shipments amounted

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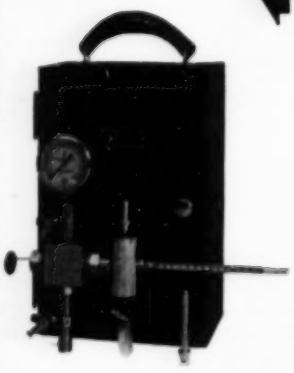
BUREAU OF MINES TYPE

for testing gases under pressure.

Records dew point of gases under pressure.



- **PRECISION DETERMINATIONS:** Bureau of mines tests show that with manipulation dew points can be duplicated to within 0.2°F.
- **ACCURACY:** Averaging test measurements, the Bureau of Mines reported less than 0.2°F. Dew point temperature difference compared to known standards.
- **SAFETY:** Hydrostatic tests show a maximum working pressure of 3,000 psi. Adjustable mirror allows for safe visual observation into the pressure body.
- **SUITABILITY:** For use with gases under pressure; at pressures from atmospheric to 3,000 psi.
- **CONTINUOUS RECORD:** of dew point gas
- **RAPID RESPONSE:** To changing dew point of gas
- **RELIABLE RESULTS:** Obtained to allow for the control of dew point of natural gas in long distance high-pressure transmission lines.

This instrument records dew point of a continuous sample of natural gas at line pressure up to 1,500 psi.

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to 51,300 units, a 3% gain over the previous June's 49,800. Shipments of boilers during the month totaled 6100 units, 1.6% below the 6200 shipped during the same month last year. Conversion burner shipments numbered 17,600 as compared with 24,800 during June of 1953.

Meanwhile, GAMA reported that domestic gas range shipments for the first six months of 1954 amounted to 952,100 units, 15.8% under the 1,131,200 shipped during the same period last year. However, June shipments increased to 152,000 ranges as compared with 149,600 shipped the previous month.

Reverse flow principle stops mechanical scurfing

Performance figures compiled by Semet-Solvay Engineering division, Allied Chemical & Dye Corp., reveal that a Semet-Solvay regenerative reverse flow high-Btu oil gas machine has operated continuously for five and a half months, on Bunker "C" oil, with no down-time for mechanical scurfing.

Credit for the highly efficient, uninterrupted operation of this process goes to the Semet-patented reverse flow principle, which provides for the burning of carbon as part of the regular cycle. The reverse flow kept the machine clean—there was no loss of heat nor loss of production, because there was no interruption in the cycle for mechanical scurfing.

It was also evident during this extended operating period that this process provided a substantially greater recovery of make oil Btu's. This is attributed to the Semet-originated down-flow action of the make oil since this method permits extended gas residence time and greater control of temperatures, both important factors for better fixing. Not only was more gas made from the same amounts of feed oil, but the closeness of temperature control made it relatively easy to produce gas to meet specific send-out requirements.

Blow-down jet can damage piping

Unless foundations are properly designed, the "jet" action of gas line blow-down valves can seriously damage a piping system, according to field reports by engineers of Rockwell Manufacturing Co.'s meter and valve division.

Action of the blow-down system was compared to a jet plane's engine. When the valve is opened, the gas issues into the atmosphere at the velocity of sound. The high-velocity jet action of the discharging gas results in a reaction in the blow-down system, causing it to move in a direction opposite to that of the gas.

In a recently investigated case, the jet effect amounted to the equivalent of 16,000 hp—far greater than the power of any jet

How a Sherman Power Digger Does More Work in Less Time with No Standby Equipment

Nearly every department in the city of Hopkins, Minnesota, finds a use for this versatile Sherman Power Digger.

The Water Department uses the machine when cutting off discontinued service lines at the main. They dig a hole in the street (usually blacktop) 3′ wide by 6′ long by 8′ deep. The hole must be plumbwalled for minimum replacement of paving. This operation used to tie up a truck all day, an air compressor half a day, and two men with hand tools, a full day.

Using a Sherman Power Digger, they now do *three* such jobs in one day, with only one man on the digger, no truck, and no compressor, except for concrete pavement. The job goes faster because they can dig the hole, shut off the line, and backfill before the walls begin to cave. Local soil conditions formerly required cribbing many of these excavations.

If *your* work involves the construction or maintenance of underground facilities, you will profit with a Sherman Power Digger. It's compact, fast, and flexible, with low initial cost and amazing economy of operation. Write today for full details, without obligation. Ask for Bulletin No. J16.

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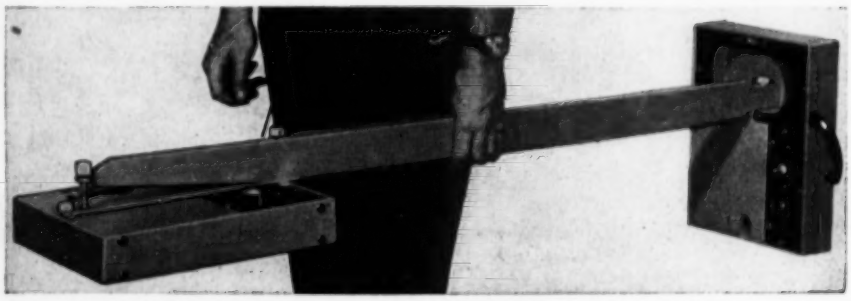

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K. Sande Senness (left), one of the first in the nation to be cited by AGA for kitchen design, features New Freedom Gas Kitchens in the 400 homes he has built in Lancaster, Calif. With him here are Ann Mantle and Jack Burke, construction superintendent.

plane in existence.

To avoid severe damage to the blow-down system resulting from this phenomenon, it is necessary to design and install a foundation that can "take" the reactive force. The jet effect is most severe at the beginning of the blow-down period: as the line pressure decreases to zero, so does the jet effect. In designing the foundation, account should be taken of the maximum force exerted by the jet effect rather than taking an average figure for the force during the entire blow-down period.

The size of a blow-down branch is usually a fraction of the pipeline diameter, and is calculated to meet the desired blow-down time. The latter may vary anywhere from one-half hour to as long as one-half day; and the shorter the blow-down, the greater the jet action. In general, gas pipelines are divided into 10-mile-long sections with a blow-down valve at the end of each section. The foundation support for each of these valves should be designed to absorb the reaction force of the jetting gas.

Free Mexico trip for top Houston dealer

The dealer who, between July 1 and Dec. 31 of this year, finances the greatest dollar volume of appliances with the Houston (Texas) Natural Gas Sysem will win an all-expense trip to Mexico City for two.

The eight-day, weekend-to-weekend trip includes round trip flight by Pan American World Airways, first class hotel accommodations, meals and sightseeing.

The winning dealer and his wife will be met by a Pan American representative in Mexico City and taken to the Del Prado hotel. They will be given a tour of the city

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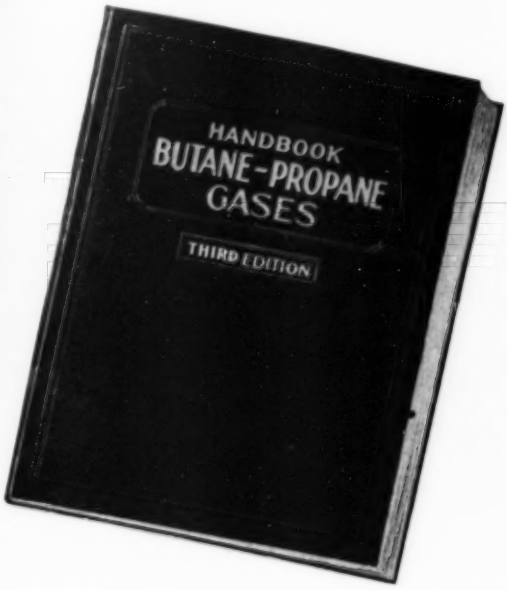

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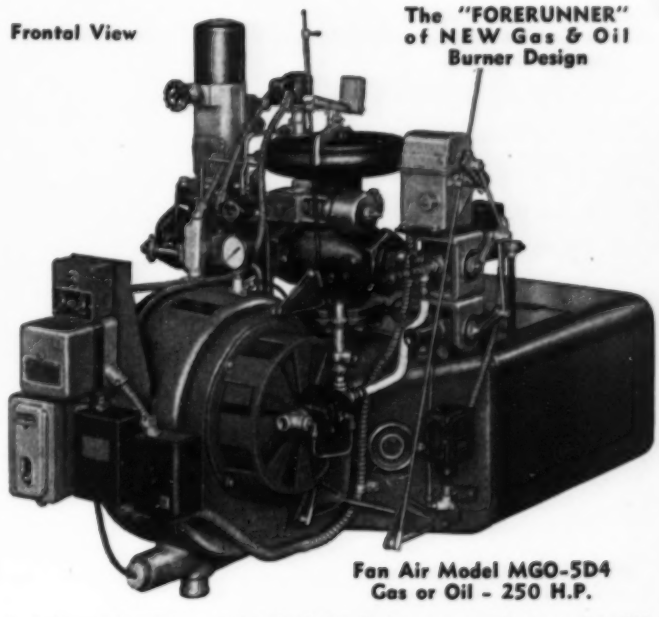

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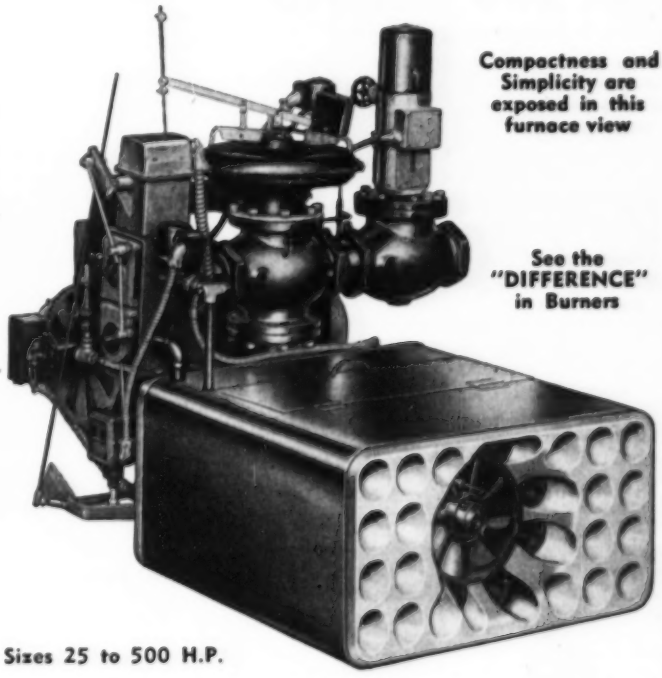

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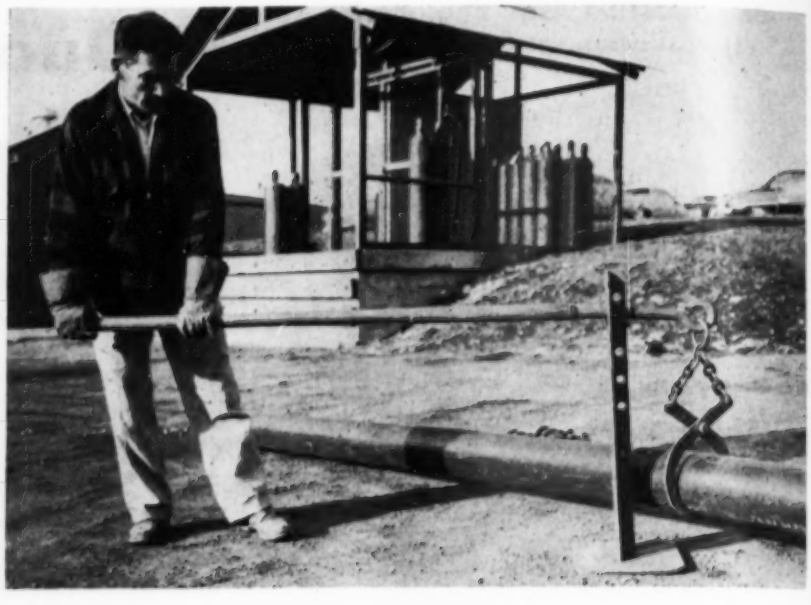

Portable pipe lifter developed by Ohio Fuel

A portable pipe lifter has been developed by the Columbus distribution district of Ohio Fuel Gas Co. that simplifies an operation that previously required from four to six men, and put them in hazardous positions.

The new device consists of two pieces of angle iron welded 1½-in. apart in an upright position on a 12-in. square of boiler plate. In the upper left of the angle iron uprights, five holes are drilled 3 in. apart for the insertion of a pin made of 1-in. cold rolled bar. Five holes are provided because of varying heights needed and different ground conditions.

A 2-ft, 6-in. lever arm, with a 4-in. hook and ¾-in. eye, fits horizontally across the pin and between the angle irons. A fulcrum is welded onto the lever arm 9 in. back from the eye. Leverage is obtained from a 5-ft length of standard 1¼-in. pipe placed over the blank end of the lever arm. To make sure the 5-ft length doesn't slip, a collar is welded on the lever arm about 16 in. from the open end.

The final part of the home-made pipe lifter is a pair of cold rolled bar ice tongs and a short length of link chain. The tongs grip the pipe, the lever arm pulls the chain taut, the jaws close, and one man can do what six men did before.

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Canadian firms vie for gas contracts

At least five companies have been organized to bring natural gas into Ontario homes "if, as, and when" Trans-Canada Pipe Line Co. completes its plans to move Alberta gas east to Montreal. These companies are eyeing some 30 Ontario communities which they feel warrant natural gas distribution systems.

All plans and efforts are tentative as neither wholesale price nor date of availability has been announced yet by Trans-Canada.

Initially, efforts are being concentrated on southern and southeastern Ontario which, it has been hinted by Trans-Canada and government officials, may have gas late next year from southwestern Ontario and U. S. fields.

Merchants Gas Co., which has a head start on the other four distribution firms, has franchises for retail gas distribution in seven Ontario centers — Gananoue, Belleville, Preston, Napanee, Arnprior and Renfrew. Other companies organized recently include Intercounty Natural Gas.

News Notes

A request by Consolidated Edison Co. of New York Inc. to convert from mixed gas to straight natural gas in Manhattan and the Bronx was approved recently by the New York PSC. Work on the project is scheduled to start in mid-September.

Michigan's PSC last month ordered the Michigan Consolidated Gas Co. to serve an additional 14,000 space heating customers. Issuance of the order followed commission approval of a Consolidated request to sell 4.8 MMcf of special industrial gas. Eighty percent of the new space heating customers will be in the Detroit area. Consolidated was directed to take "appropriate steps" to obtain revision of the Michigan-Wisconsin Pipe Line Co. tariff to permit addition of the new space heating customers.

Southern Counties Gas Co., Los Angeles, is running a series of tests to determine the feasibility of expanding injection and withdrawal facilities at the Playa del Ray underground storage project with a view to increasing its value as a standby "holder" for short-term peak demands. During an initial four-day test, 186 MMcf of gas was recently pumped into wells at the project at a rate 150% faster than ever before. This leads to the conclusion that with increased compressor and pipeline facilities, and with increased withdrawal outlets, the effectiveness of the field as a standby holder might easily be increased at least one and a half times.

To provide for rapidly expanding sales in domestic and export markets, American Tractor Corporation of Ft. Wayne, Ind., has recently secured $500,000 in additional working capital, with promise of more as needed. Financing was arranged by Elliot & Co., members of the New York Stock Exchange. Since taking over the original Clark airborne (military) tractor in 1950, American Tractor has produced a completely new line of improved gasoline and diesel crawler tractors. The company is also manufacturing its own line of matching attachments including dozer blades, front end-loaders, fork-lifts, grab-lifts, snow plows, and a three-point hydraulic control system for rear-mounted tools.

The Dallas city council recently approved plans of the Lone Star Gas Co. to lay $100,126 worth of gas mains to serve new additions.

Selas Corp. of America recently announced the formation of a new company,

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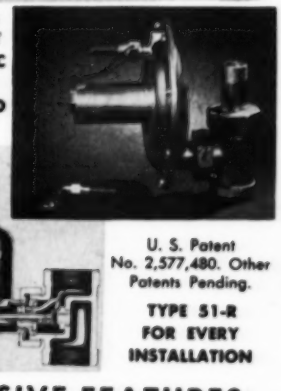

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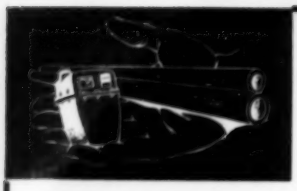
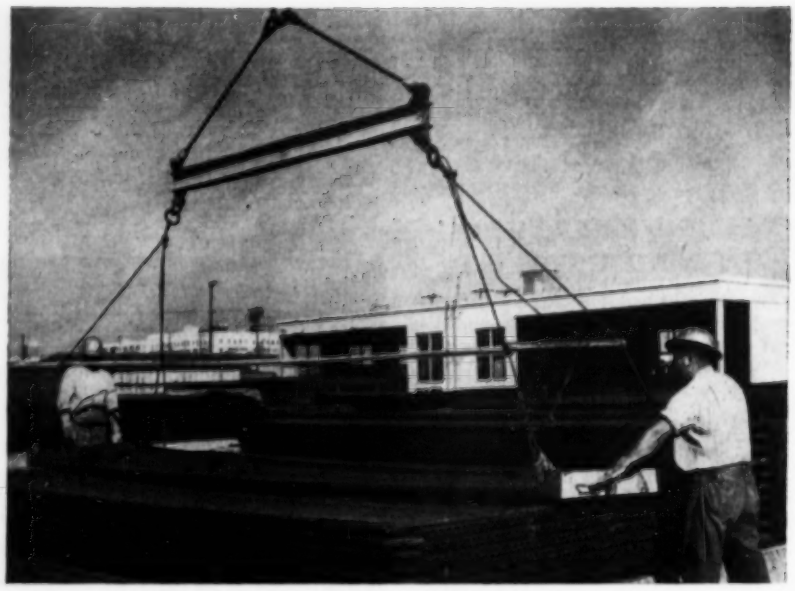
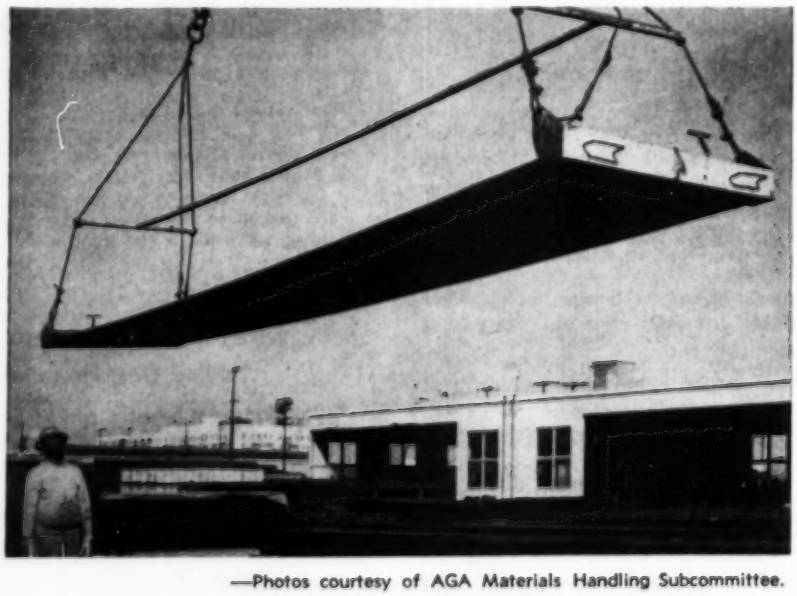


SHORT CUTS IN MATERIALS HANDLING: **2**

Loading buckets for small pipe



Southern California Gas Co.'s "loading buckets," used to load small pipe from stockpiles to trucks, consists of two buckets, cable spreader, and spreader bar. The spreader bar is 10 ft, 6 in. long; the cable spreader is 2-in. pipe 18 ft long with 3-ft end pieces. The buckets are 5 in. deep by 5 in. high by 46 in. long. The spreader bar is used interchangeably with the buckets and with hooks for large pipe. The cable spreader is used to keep the buckets far enough apart for easy handling yet will clamp the pipe in the buckets. The individually shop made buckets will handle 30 lengths of ¾-in. pipe, 22 lengths of 1¼-in. pipe, and 14 lengths of 2-in., 11 lengths of 3-in., and 9 lengths of 4-in.



—Photos courtesy of AGA Materials Handling Subcommittee.

Radiamatic Corp. Selas' President Frederic O. Hess reported that the new corporation, organized in Deleware, will specialize in the generation and utilization of radiant energy. Mr. Hess will be president.

Minneapolis-Honeywell Regulator Co. has announced the establishment of a nationwide network of training aid libraries as part of a program to help dealers, wholesalers, and builders better understand the operation of automatic temperature regulating devices. Training aid centers will be established in 24 major U. S. cities and in two Canadian cities, and will provide company sales engineers with visual aid materials to be used in meetings and for the announcement of products and for discussions.

Announcement has been made of the appointment of the Snyder Co., Houston, as exclusive representatives in the Houston and Corpus Christi area for Robinson Orifice Fitting Co., Los Angeles. Snyder has long been Robinson's representatives in Kansas City, Tulsa, Odessa, and Dallas. Jack Ribble, associated with Phillips Petroleum Co. for over 20 years, has been named manager of the Houston office. He will be assisted by L. M. Petrie, formerly sales engineer in the Odessa office for Snyder.

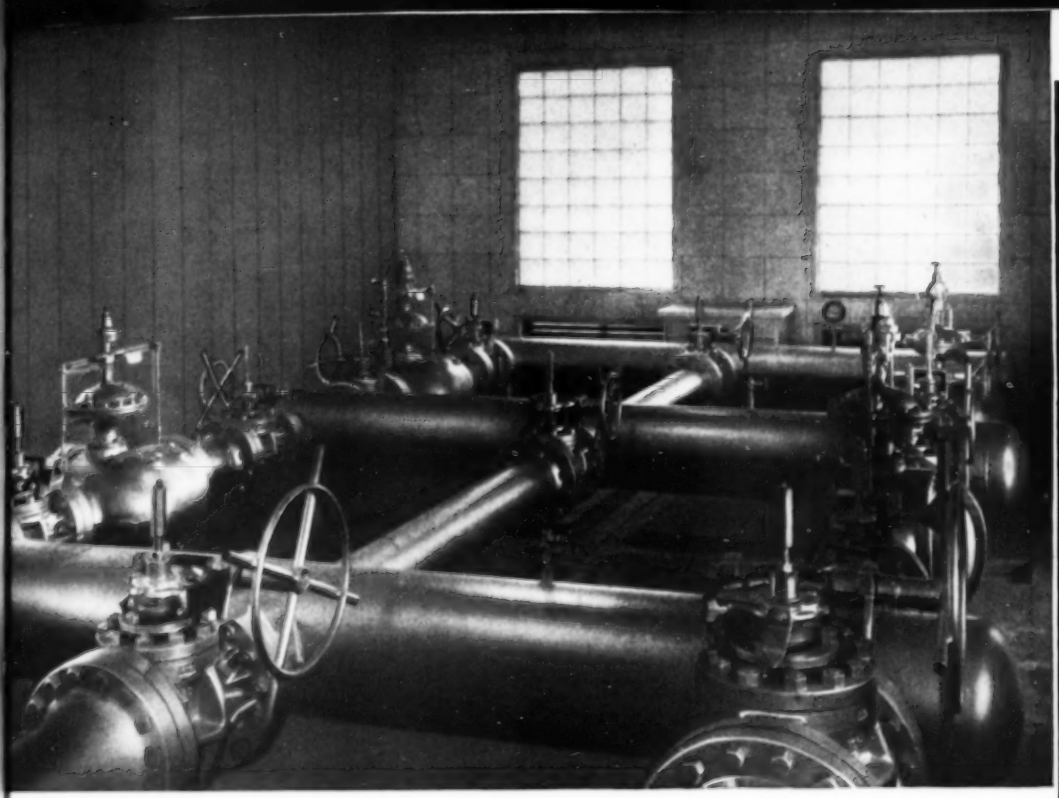
Washington's Public Service Commission authorized the Portland Gas & Coke Co. recently to increase its gas rates in the Vancouver area. Designed to give the utility a return of 5% on its total investment, the increase will boost the average bill of residential users having a gas range and water heater about 36 cents a month. The PSC also authorized the company to change its method of billing as a preparatory step for the advent of natural gas in the Northwest.

Carlon Products Corp., Cleveland, reports that Gas Service Inc. of Nashua, N. H. is using Carlon plastic pipe for gas mains and service lines servicing a new section of the community. Pipe laying crews reportedly find the plastic pipe easy to handle and install. This first installation of its type in New England is expected to reduce the cost of natural gas in the area it supplies.

Grove Regulator Co., Oakland, Calif., announces that its Los Angeles offices have been moved to 1930 West Olympic Boulevard. The move is part of a nation-wide program of adjustment to handle increased activity resulting from the development of the company's new Seal-"O"-Ring gate valves.

Eastern States Supply Corp. has recently been appointed manufacturer's representative and distributor by the J. P. Glasby Manufacturing Co. Inc. It will serve the New England, New York state, and Long Island areas offering the entire Glasby line. Offices are located in Springfield, Mass. and in Long Island City, N. Y.

GAS Transmission and Conditioning Section



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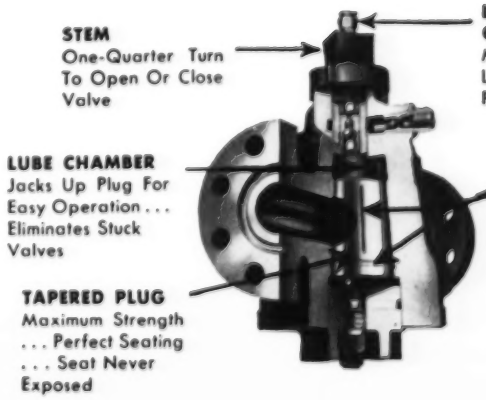
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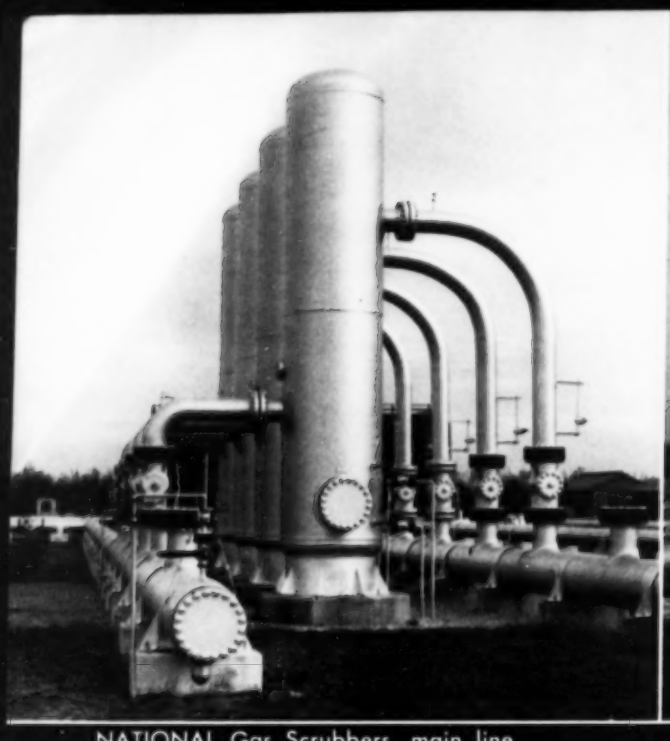
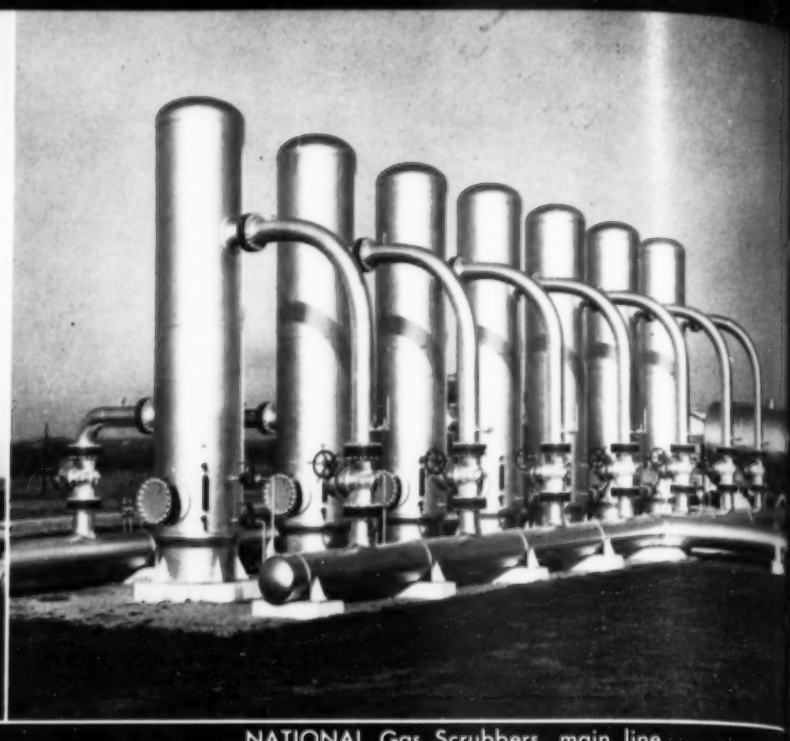
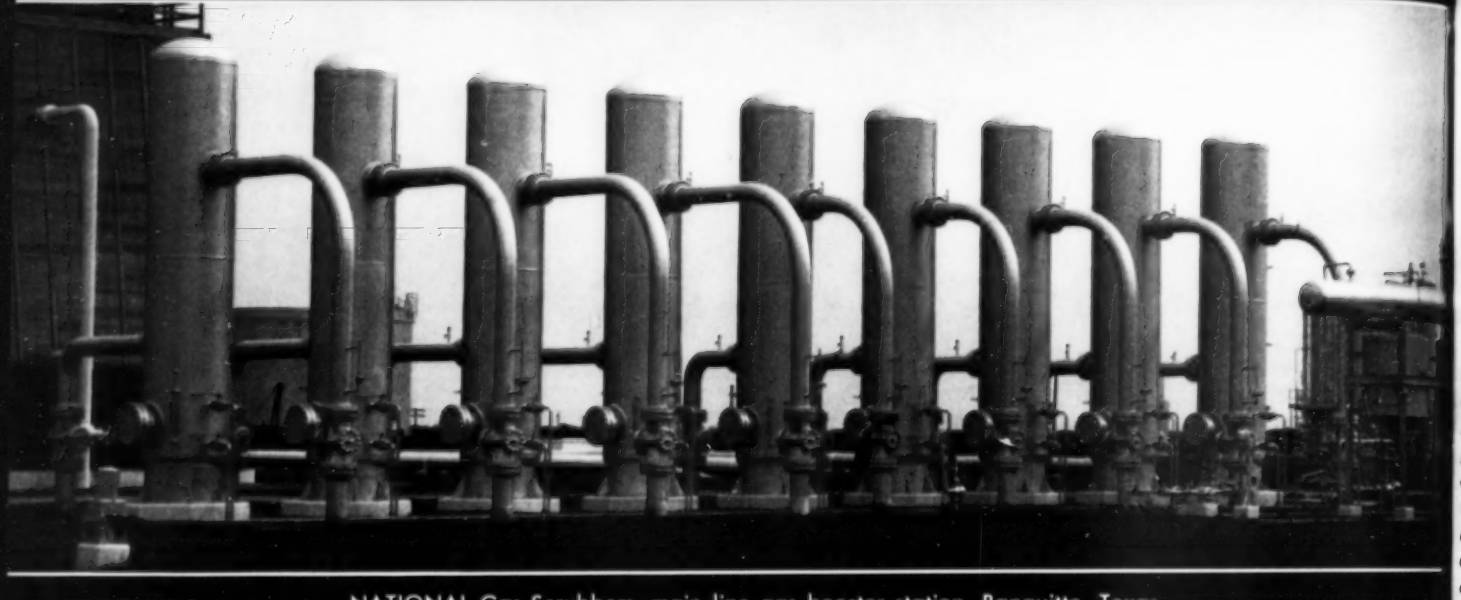


NATIONAL Gas Scrubbers, main line gas booster station, Batesville Miss.



NATIONAL Gas Scrubbers, main line gas booster station, Monroe, La.



NATIONAL Gas Scrubbers, main line gas booster station, Banquitte, Texas

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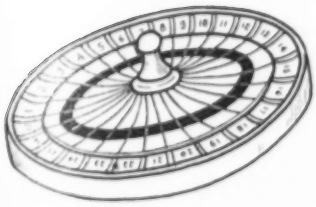


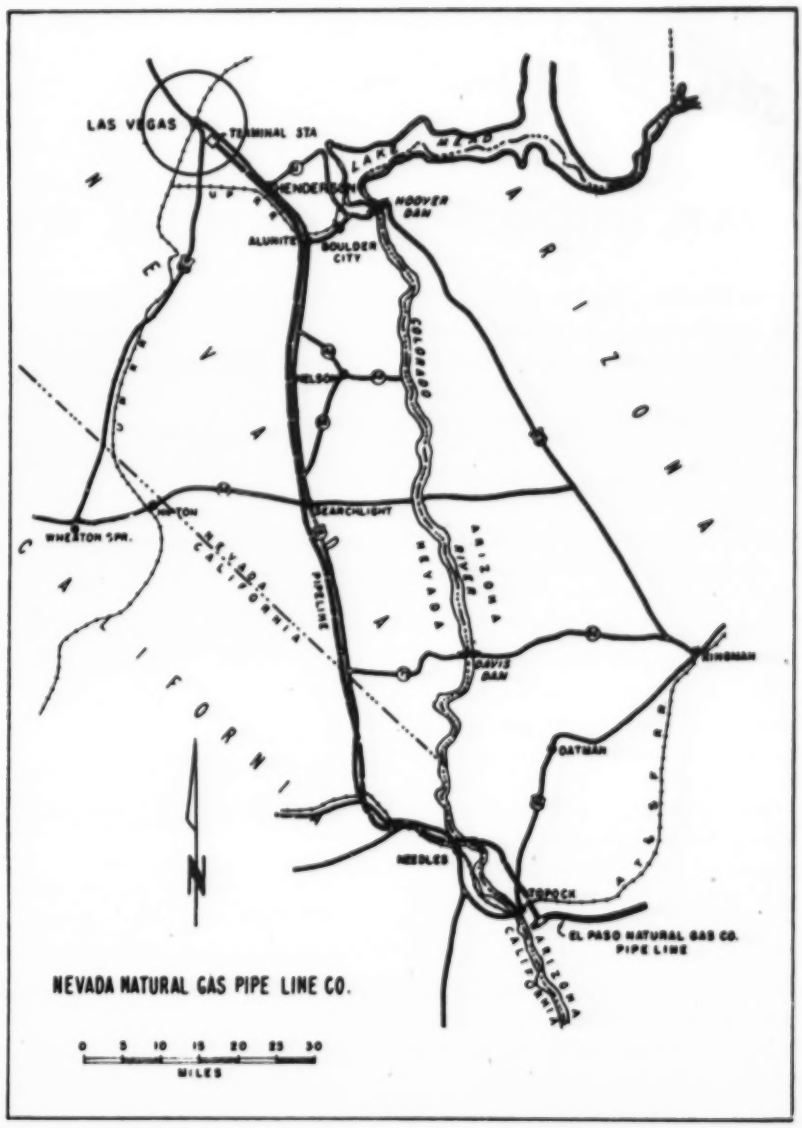
In Las Vegas natural gas is a "sure thing"

Las Vegas and the southern tip of Nevada, traditionally a hydro-electric power-minded area because of the proximity of Hoover dam and its power generating facilities, is today counting on natural gas to provide the fuel requirements of its ever expanding industrial, commercial and residential development.

The rapidly developing natural gas picture in the area is centered around a recently completed gas pipeline, built by the Nevada Natural Gas Pipe Line Co., to bring natural gas into the area from one of the major cross country lines. The retail distribution of natural gas in Las Vegas and vicinity will be handled by a newly formed corporation, called the Nevada Southern Gas Co., which only last month took over control of the city's former propane-air distribution system.

The availability of an abundance of water and natural resources in the area has attracted an extensive industrial development. Its resort type weather and liberal laws have fostered an equally rapid expansion of entertainment and recreational activities. Together these factors swelled the area's population over 192% during the decade preceding 1950. Amazingly enough continued growth has at least doubled the population since 1950.

One of the results of this phenomenal growth has been an unprecedented demand for fuel—far beyond the capability of either the gas distribution company or the supplier of electric power to deliver. How natural gas will be made to solve the problem is described in the following article.



H. G. Laub (right), president of Nevada Natural, discusses construction details with R. H. Fulton (center), president of R. H. Fulton Co., contractor, and George W. Stevenson, manager of West Coast operations of American Meter Co. Photo at right shows typical terrain in which the pipe was laid.

In three parts

1. **An important market awaits development.**
2. **Streamlined design, laying methods, sped construction and cut costs.**
3. **New distribution company formed to meet challenge of market potential.**

SURE THING!

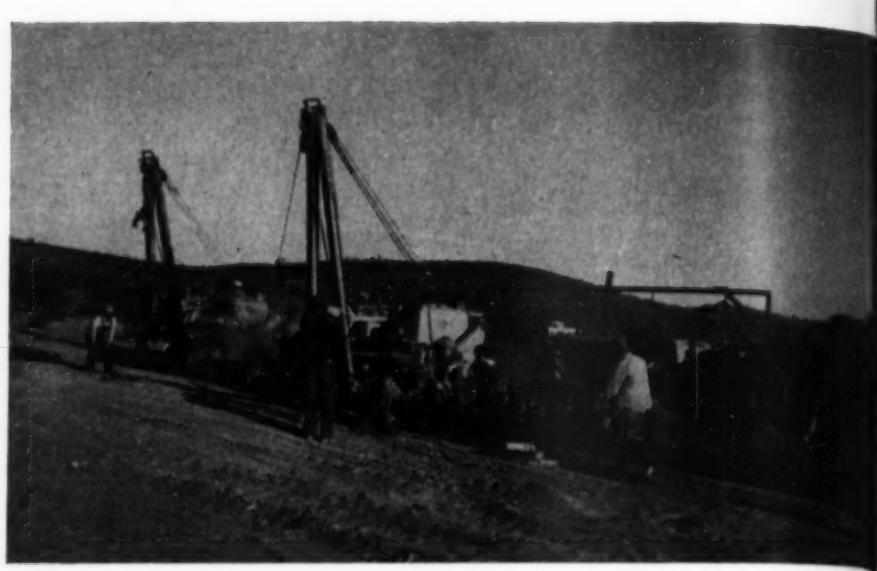
1. An important market awaits development

ANOTHER state was added to the country's rapidly growing list of natural gas consuming areas earlier this year with the completion of a 114-mile, 10-in. pipeline from near Topock, Ariz., to Las Vegas, Nev. Built and to be operated by the Nevada Natural Gas Pipe Line Co. to serve the cities of Las Vegas and Henderson, Nev., along with the adjacent industrial area, the line makes Nevada the 43rd state in the nation to receive natural gas.

Of greater importance to the people of the area, however, than the mere arrival of another natural gas consuming state on the scene is the fact that the new line will help to supply the fuel requirements of its ever expanding but fuel-starved industrial, commercial, and residential development. With an authorized daily capacity of 20 MMcf, the line is capable of providing the normally electric power-minded area with the energy equivalent of about one-third of the total generating capacity of nearby Hoover dam available to the Las Vegas area.

Although Hoover dam, at the time of its construction, was expected to provide Los Angeles and the entire southwestern corner of the United States with an almost unlimited supply of inexpensive electric power for many years to come, the growth of business and industry in the area, and in Los Angeles and San Diego particularly, during the past several years has far outstripped past estimates of fuel consumption. The Las Vegas-Henderson area, because of its geographic location adjacent to the dam, has more heavily relied upon it as a source of power than other areas more removed. Below normal water supply in the Colorado river has already forced a 12% cut in electric power available to Los Angeles from Hoover dam.

The state of Nevada entered into a contract with the U. S. in 1941 for 17.6259% of the firm energy to be generated at Hoover dam. This contract terminates in 1987 and represents all the electrical energy presently available to southern Nevada even though the growth in this area increased 192% between 1940 and 1950.



In the joining operation, the side boom cats leap frog each other along the line, picking up a 38-ft section of pipe, which they hold in place while the pipe is set and the initial weld made.

The shortage of electric power in the Las Vegas area is so acute, in fact, that the electric distribution company has recently installed demand-limiting devices on services to customers using electric energy equipment for space heating purposes.

The Nevada Natural Gas Pipe Line Co., organized for the purpose of building and operating the new $2 million pipeline, is headed by Harold G. Laub as president and director. Other officers are Jay Jenkins, vice president and director; Joseph W. Wells, vice president and director; Edward Berol, John E. Carroll, E. J. Evans, and Howard Lang, directors. Mr. Laub, a 25-year veteran in the gas industry, is also president of Southwest Gas Corp., the distribution company serving the cities of Victorville and Barstow, Calif. He has been responsible for the design and construction of the line and is in charge of general operations. Mr. Jenkins is publisher of *GAS* and other technical magazines. Joseph W. Wells is president of Wells Cargo, which operates extensive trucking facilities in California, Nevada, Utah, and Idaho. He also heads a contracting firm building roads, water, gas and sewer lines.

Gas is purchased from the El Paso Natural Gas Co. at a junction point near Topock on the Arizona side of the Colorado river. Delivery is made to city gate stations at Las Vegas and Henderson, and to industrial customers in the area. The line crosses the Colorado river on a company-owned suspension bridge at a point about 15 miles north of its junction with the El Paso line and extends northward through desert country along U. S. Highway 95. It terminates just east of the city of Las Vegas.

The Las Vegas Gas Co., formerly a propane-vapor system, has been converted to distribute natural gas in the city of Las Vegas. The California-Pacific Utilities Co., the electric power distributor in Henderson, which also originally supplied propane-vapor to its customers, will distribute natural gas in that city. An extensive and steadily growing industrial development adjoining the city of Henderson, occupying an area that was formerly the government's Basic Magnesium Project, is supplied directly from Nevada Natural's mainline. Potentially the largest single load, however, is a new gas-fired steam

generating plant for which contracts have already been let by the Southern Nevada Power Co., electric power distributor for the Las Vegas-North Las Vegas area. This load will also be supplied from the company's mainline.

The Basic Magnesium plant, built during the early years of World War II, was acquired by the state of Nevada after the government's magnesium operations were discontinued in 1944. The area is now largely occupied by private industries, most of which have either made or propose to make substantial expansion of their facilities. The industrial development has resulted in the growth of the city of Henderson from nearly barren desert land prior to World War II to a point where it is now the third largest city in the state.

The development of private industry in the Basic Magnesium plant area now includes Western Electrochemical Co., U. S. Lime Products Co., Titanium Metals Corp., Stauffer Chemical Co., and Manganese Inc. The area includes some 150 buildings with more than 3.3 million sq ft of floor space. The pipeline passes along the edge of the area and a 5000-ft long, 10-in. lateral has been built into the area for industrial services.

The new steam generating plant to be built by Southern Nevada Power is expected to go into operation by Dec. 15, 1955, with an initial capacity of 44,000 kw. The power company has contracted for the firm delivery of 1.5 MMcf per day, starting in December 1955 with an option to take any available surplus. Planned expansion to these facilities calls for doubling the plant's capacity to 88,000 kw in another three to five years. Estimated maximum daily gas load is about 12 MMcf during the first three years of operation with an increase to 24 MMcf when the plant goes to full generating capacity.

The Stauffer Chemical Co., which also supplies steam to a considerable portion of the industry in the former Basic Magnesium plant area, is one of the largest present industrial users of natural gas. Three gas-fired steam boilers currently in operation use 120 Mcf per hour at maximum steam generating capacity of 100,000 lb per hour. Present actual load has averaged nearly 2 MMcf per day. The boilers were converted from fuel oil to natural gas upon completion of Nevada Natural's line into the area. In addition to this boiler load and other incidental uses, Stauffer Chemical is considering use of natural gas in the manufacture of petrochemicals.

A load nearly equal in size, with somewhat larger potential, is that supplied by the lime kilns of U. S. Lime Products. With three of four kilns presently operating on a mixture of gas and oil, having been converted from fuel oil, the load has averaged around 1.5 MMcf per day.

Conversion of the kilns from fuel oil to an oil-gas mixture required considerable experimentation because of the nature of the flame necessary for proper processing of the lime. The speed at which the lime moves through the long, rotating, tube shaped kiln is determined by the heating effect of the flame that extends through its center. The rate at which the lime moves is regulated by the speed of rotation of the kiln. For proper processing the heating must take place progressively and reach a specific value at the time the stone falls away from the kiln under the nozzle.

It was found that the heating effect of a flame resulting from the burning of an oil-gas mixture extended a greater distance down the kiln from the nozzle than that resulting from the use of straight fuel oil. Some fuel oil was required to provide sufficient heating in the immediate vicinity of the nozzle; at the point where the lime dropped away from the kiln. Therefore, a mixture of 90% natural gas and 10% fuel oil was found to satisfy the two conditions of heating in the vicinity of the nozzle and heating that extended a distance up the kiln.

The Las Vegas Gas Co., presently the wholly owned subsidiary of the Nevada Southern Gas Co.,* is expected to more than double its number of customers by the end of 1954 or early 1955. The company now has more than 4000 meters in service. It had over 1600 customers at the end of 1952. The present daily load averages nearly 1.5 MMcf with estimated peak days to run as high as 11 MMcf. An eventual saving of 30 to 40% in the city's fuel bills is estimated.

Domestic and commercial heating and all year air conditioning promise to supply the greatest single gas load in the city of Las Vegas. The combination of daytime summer temperatures above 100° and the desert's chilly nights, with temperature differentials of nearly 100°, makes the city an ideal candidate for all-year air conditioning. The resort hotel business, which continues to grow at a fast pace, will provide a considerable portion of this load through conversion from present oil-fired heating and the installation of new heating and air conditioning units. The heating of numerous swimming pools in the area represents an appreciable fuel use. In the domestic field the widespread construction of tract housing with luxury type equipment provides a logical market for all-year home air conditioners.

Servel Inc., which is taking an active part in the promotion of all-year gas air conditioners in the Las Vegas area, predicts that its sales will likely increase in greater proportion than the decrease in the cost of gas service. The Las Vegas area should enjoy one of the highest saturations of gas air conditioning in the country. The estimate includes both domestic and commercial use of all-year air conditioners. Servel's survey of domestic use indicates that all new homes of 1400 sq ft and over will have all-year air conditioning.

Another factor in the air conditioning picture in the desert areas has been the unpredicted rise in humidity, which has caused a decrease in the use of conventional evaporative type coolers. This trend, which is apparently caused by the increased use of irrigation in the desert, has led to widespread substitution of refrigerative type air conditioners for evaporative coolers in the medium class domestic use.

In addition to the city load, the Las Vegas Gas Co. also supplies gas to the installations at nearby Nellis Air Force Base and its housing development. The conversion to natural gas has taken the company's four propane-air plants out of service. Conversion of the city, started on March 20 and completed in mid-June, was undertaken on weekends by experienced outside crews employed on other jobs during the week.

The city of Henderson, however, was the first city in the state to receive natural gas when, on March 1, gas was delivered to the city gate station. Conversion of the city's 518 customers was started on that date and completed on March 12. With some $160,000 budgeted for the installation of new services and mains, California-Pacific Utilities Co. expects to have nearly 2000 customers on the line before the end of 1954. (Present population of the city is estimated at 10,000.) At the same time it is estimated that the changeover to natural gas will result in a 20 to 27% reduction in the city's gas rates.

*See Part 3, beginning on page 117.

2. Streamlined design, laying methods, sped construction and cut cost

EVIDENCE of the fact that an industry's ability to get things done is most often apparent in those projects undertaken by a small and closely knit organization is exemplified in the construction and operation of Nevada Natural's pipeline.

The methods resorted to in designing and building the line and the efficiency with which it is operated and maintained are a credit to the industry's resources and a source of pride to those in the larger gas companies who, although having had a part in the formulation of the industry's stock of know-how, have often found their own companies too large and unwieldly to permit them to take advantage of many worthwhile design techniques and operating practices.

Nevada Natural engineers and representatives of Consolidated Western Steel Corp. undertook an engineering analysis of the requirements for the pipe that could be used in the construction of the line with an eye to finding a high yield and tensile strength pipe with minimum wall thickness. As a result of their work it was determined that by using the proper proportion of carbon and manganese in the composition of the steel it was possible to affect a saving of 1/16-in. in pipe wall thickness. Pipe with a yield point that varied between 43,500 psi and over 48,000 psi and tensile strength between 68,000-75,000 psi was designed with a wall thickness of-3/16 in. All pipe was individually tested at the mill to a minimum of 125 psi. Normal wall thickness would have been ¼-in. for the pipe operating at these pressures.

The 114-mile line required some 7400 tons of pipe as against more than 9000 tons that would have been required in ¼-in. wall thickness. Aside from the saving in steel and its cost, the use of thinner wall pipe also resulted in a considerable economy in transportation and handling costs.

All welding was done by electric welding process. Welding rods met the American Welding Society specifications or Lincoln Fleetweld requirements. Tack welding was not permitted.

Striking the welding arc on the pipe at any point other than the welding groove was not permitted. General acceptance of the weld was based on API standards.

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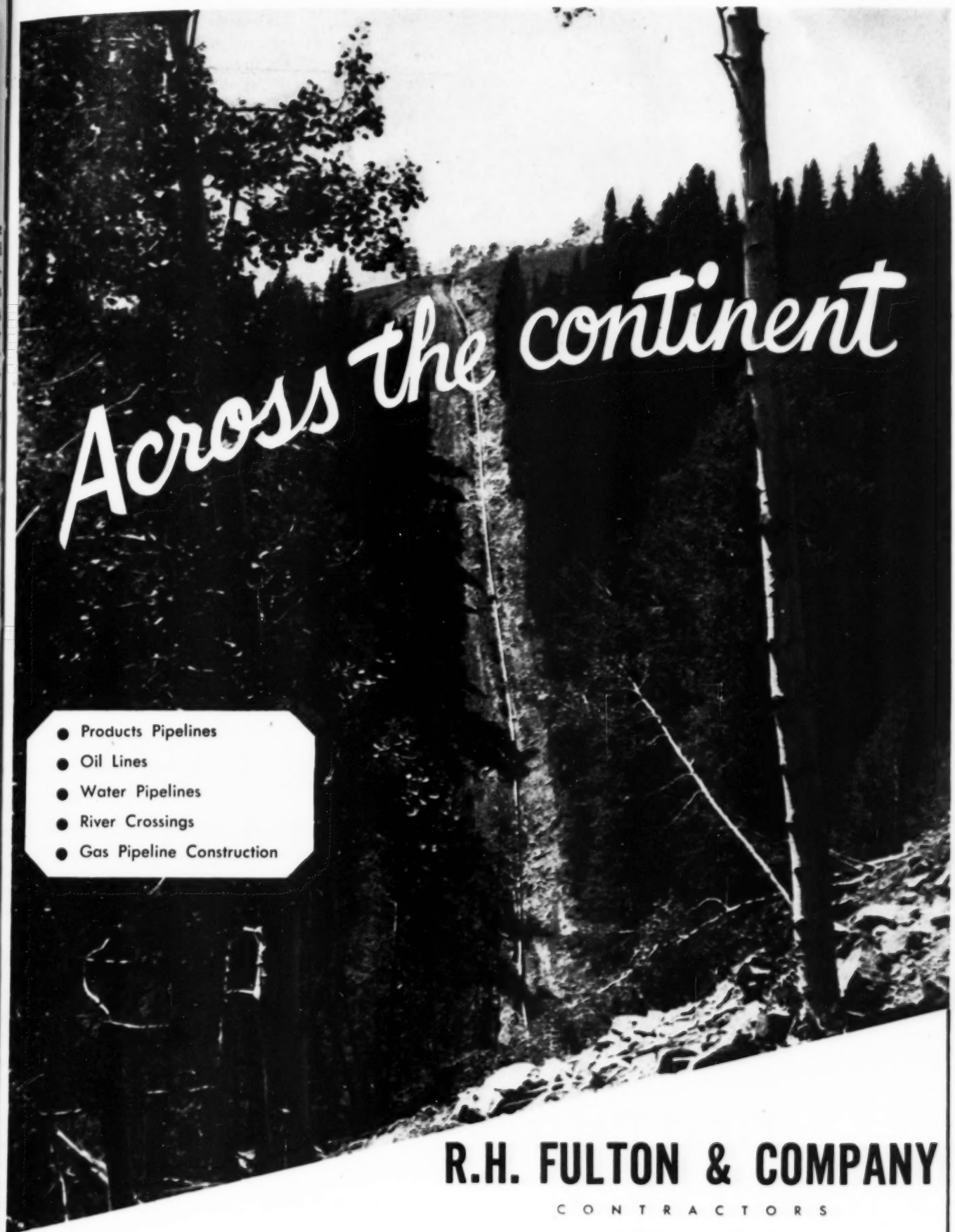

R.H. FULTON & COMPANY

CONTRACTORS

LUBBOCK, TEXAS

The side boom cat, in back of the pipe, drags the polishing and prime coat machine along the pipe to provide a thin coating of tar preparatory to wrapping. The man on the extreme right, holding the long bar, is there to hold the machine steady on the pipe.

Long radius welding ells, Tube Turns, or equal were used for all angles over 10°. Cold smooth bending was permitted but not closer than 12 in. to the nearest weld.

Ground temperature tests conducted over many years by a major utility in similar terrain* indicated that cover up to 3 ft would not appreciably change the temperature range that the pipe would be subject to.

Consideration of the two facts that the line was to be laid in dry desert land where it would not be subject to frost conditions and that the gas was dehydrated and conditioned before delivery by the El Paso Natural led to the laying of the line under a 12-in. average cover except in wash crossings and other special locations. Additionally, where the right-of-way encountered a substantial rock formation the line was laid on "A" frame supports rather than in a trench that would need to have been blasted out of the rock and then conditioned for the pipe.

In undertaking the line laying operation, R. H. Fulton & Co. completed the casing installation of all road and railway crossings before starting on the line itself. In this way it was possible to speed up the actual line laying process to a marked degree.

An important expedient undertaken for the purpose of placing the line in operation at the earliest possible time was the laying of a temporary 6-in. crossing in the bottom of the Colorado river at the river crossing site. The line was laid in a wide arc and allowed to move to seek its own bed with any change in the river current. Use of the "roped" line also resulted in the mini-

*By the Southern California Gas Co. in the San Joaquin valley and over Tehachapi.

NEVADA NATURAL GAS PIPE LINE COMPANY

This pipeline company was entirely financed by our organization through funded debt, privately placed with institutions and through the public sale of common and preferred stocks.

Our organization is engaged in underwriting and distributing investment securities and invites inquiries regarding financing.

FIRST CALIFORNIA COMPANY

Incorporated

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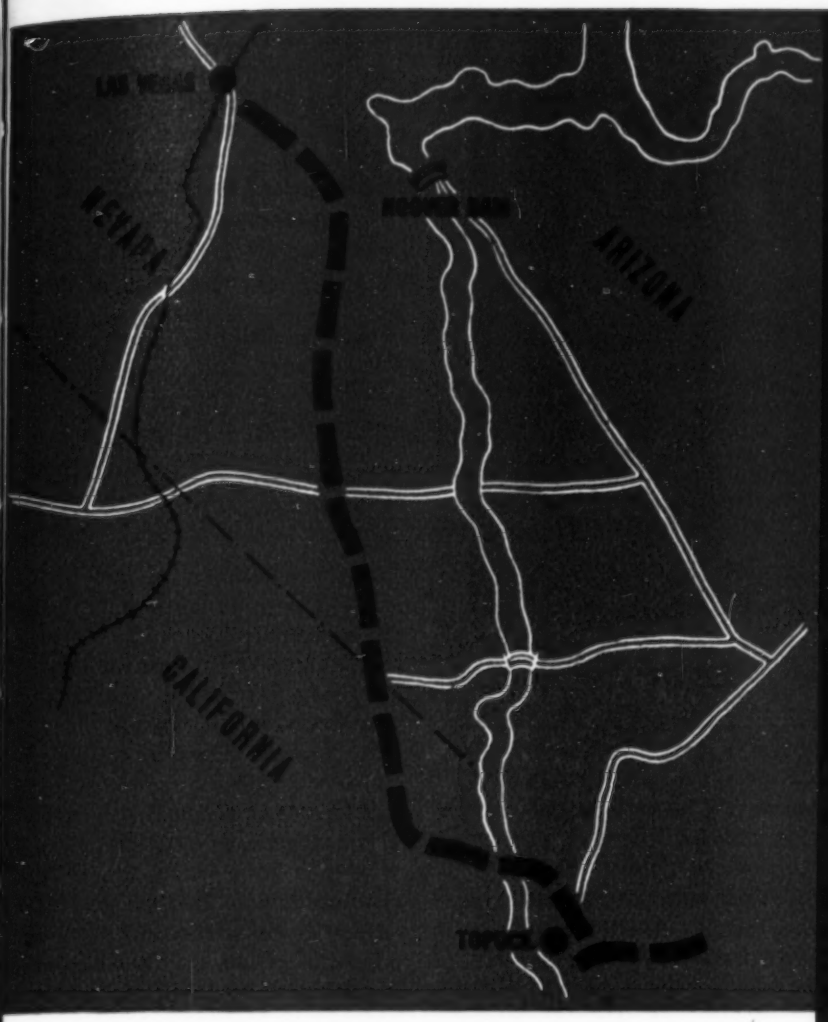


NEVADA NATURAL GAS PIPE LINE COMPANY 100% AMERICAN® EQUIPPED

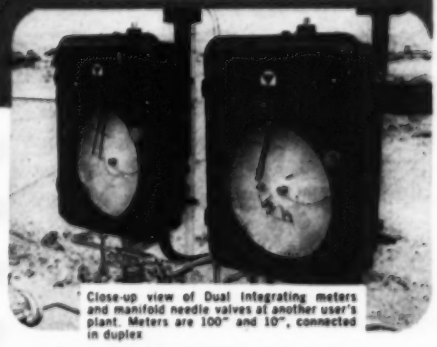
Spanning 117 miles of desert terrain, crossing the Colorado River en route, the lines of Nevada Gas Pipe Line Company reach from Topock, Arizona to Whitney, Nevada. Every foot of the line as it spans parts of three states is served by American measurement and regulation equipment. And ultimate consumers, both industrial and residential, are served by American Meters as well.

American Meter Company is proud of the part it has played in this $2,000,000 plus development that brings better natural gas service to a fast-growing industrial and residential area. Here—as in many similar projects across the country—American equipment brings dependability, accuracy and safety to gas suppliers and customers, just as it has done for nearly 120 years.

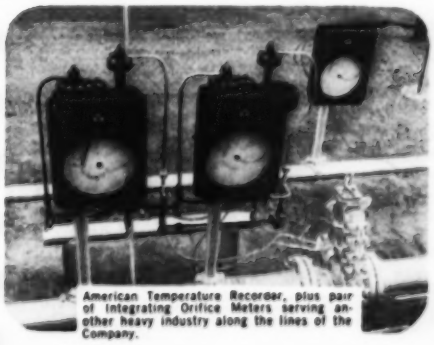
SCENES ALONG THE 3-STATE COMPANY ROUTE SERVED 100% BY AMERICAN EQUIPMENT

Type P and Type Z Reliance Regulators, plus 100" and 10" A-88 Integrating Orifice Meters at Henderson, Nevada Border Station. Working pressures average 420 psi and 27,000,000 cu. ft. daily capacity.

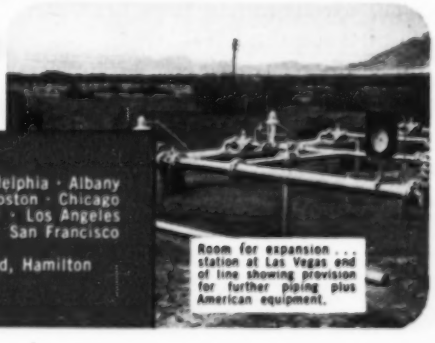
Types P and Z Reliance Regulators and A-88 Orifice Meter serve typical industrial customer along the line.



Close-up view of Dual Integrating meters and manifold needle valves at another user's plant. Meters are 100" and 10", connected in duplex



American Temperature Recorder, plus pair of Integrating Orifice Meters serving another heavy industry along the lines of the Company.



Room for expansion . . . station at Las Vegas end of line showing provision for further piping plus American equipment.

AMERICAN® METER COMPANY

GENERAL SALES OFFICE: 1513 Race Street, Philadelphia · Albany · Alhambra · Atlanta · Baltimore · Birmingham · Boston · Chicago · Dallas · Denver · Erie · Houston · Kansas City · Los Angeles · Minneapolis · New York · Omaha · Pittsburgh · San Francisco · Seattle · Tulsa

IN CANADA: Canadian Meter Company, Limited, Hamilton · Edmonton · Calgary

Watching the welder do his job are (from left) R. H. Fulton; Mike Curran, of M. J. Crose Manufacturing Co.; Gene Sallee, Nevada Natural; and Jerry Nash, of R. H. Fulton Co.

mum stress being impressed by the river flow. Necessary precautions were taken by consultation with Reclamation Department engineers at Boulder City to determine the estimated river flow, change in course and percentage of silt (which affects buoyancy) that might be expected during the period that the crossing would be in operation. Although the present line crossing is on a three-pier suspension bridge at the same point, temporary use of the river bottom line allowed the line to be put into operation at least three months before it would have been under normal construction practice.

The line was coated and wrapped over the ditch using National Pipe Coatings' asphalt and Kraft paper. Further provision for protection was made by setting up electrical test point stations at 4000-ft intervals along the line. At each of these points a length of rusty iron pipe is buried and separated from the mainline by a redwood block. Electrical test point lines consisting of wrapped ¾-in. pipes, across which electrical potential may be read, are brought to the surface from both the rusty pipe and the line.

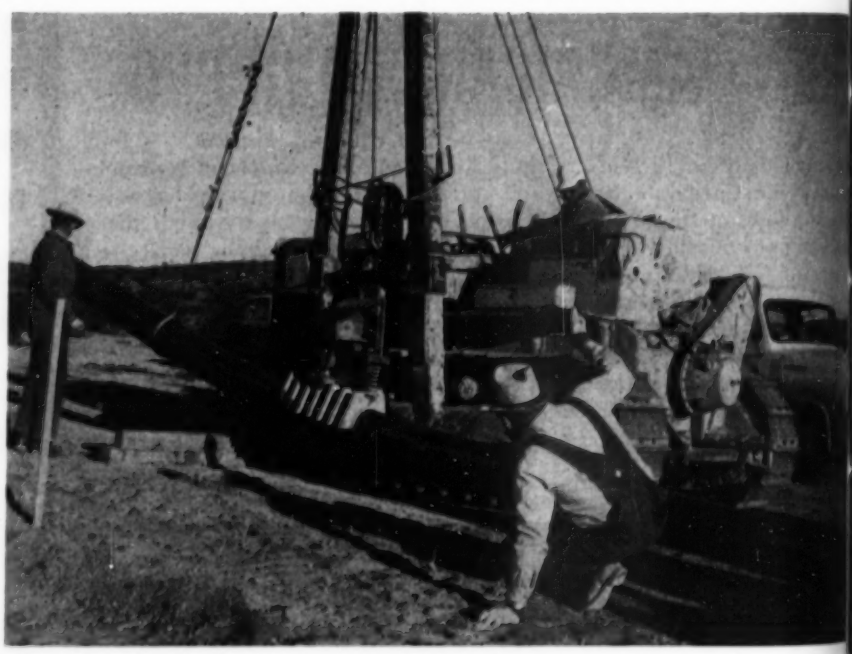
In addition to these construction techniques, consideration was given to efficient operation and maintenance of the line. A policy of standardization in line equipment was adhered to so that stock of spare parts might be kept at a minimum and unskilled labor used for normal maintenance procedures. While such a practice might result in an additional investment in equipment on installation, it is more than underwritten by the resultant saving in inventory and maintenance costs.

All line regulators, for instance, are Reliance Type P with valve and venturi orifice that can be changed to allow for increased capacity. All valves are Nordstrom ASA 300 and 400 class in sizes from 10-in. down. Similar standardization is carried out in all Robinson orifice fittings and bored tubes used on the line. All orifice meters are 10-in. and 100-in. Metric meters, depending upon the load fluctuation. Where a constant load is experienced, such as on lines to industrial plants, 100-in. gauges are used, whereas on fluctuating loads provided by city distribution systems both 10-in. and 100-in. gauges are used.

By so standardizing on line equipment one stock of parts can suffice for the entire line and a maintenance employee, once acquainted with one type of valve, regulator or meter, is in a position to service any on the line. Such a practice tends to keep the maintenance cost of the line in proper proportion to its overall cost. From an operational point of view it provides more assurance of fool-proof repair and maintenance.

The line receives gas from El Paso within a pressure range of 500 to 600 psi, and delivers gas at about 50 psi to Las Vegas at its northern terminus. Mainline valves are located at about 12-mile intervals along the length of the line. A removable blow-off stack arrangement and blowdown valves are located at each of the mainline valves. This arrangement consists of a 4-in. valve and plate on each side of all mainline valves. The removable blow-off stack, which also contains a sampling connection, may be mounted on any of the valves when the cover plate is removed.

Gas supplied to Las Vegas is measured in two 6-in. orifice meter runs with a single bypass line, and gas to the city of Henderson is measured in one 4-in. orifice meter run.



A side boom cat bends the 10-in. pipe under the direction of the foreman, kneeling at right.

3. New distribution company formed to meet challenge of market potential

MOST recent development in Southern Nevada's rapidly growing natural gas picture was the purchase, on Aug. 11, of the Las Vegas Gas Co., by a newly formed corporation.

The distribution system, which serves the city and portions of the surrounding territory, was converted from propane vapor to natural gas during the summer of 1954, following completion of the Nevada Natural Gas Pipe Line Co. 114-mile link between Las Vegas and the El Paso Natural Gas Co. mainline from Texas gas fields.

The new company, to be known as The Nevada Southern Gas Co., will be headed by Harold G. Laub as president and William M. Laub as vice president and secretary-treasurer. H. G. Laub is also president and director of Nevada Natural Gas Pipe Line Co. and president of Southwest Gas Corp., the distribution system in the towns of Victorville and Barstow, Calif. All negotiations for the purchase and financing were handled by the First California Company of Los Angeles.

Other officers and directors include E. J. Evans, D. C. Baum, and Jay Jenkins of Los Angeles; Joe W. Wells and Robert B. Griffith of Las Vegas.

In addition to the city of Las Vegas, the company distributes gas in the incorporated area of North Las Vegas, the small community of Whitney, about eight miles southeast of the city; Nellis Air Force Base and its adjacent Wherry housing project, and the areas on each side of several principal highways radiating from Las Vegas, including the "Strip" area of resort hotels and casinos.

A 14-mile long, 10-in. pipeline was recently laid by the Las Vegas distribution company from Whitney, the northern terminus of the Nevada Natural line, to a connection with the distribution system and to Nellis Air Force Base.

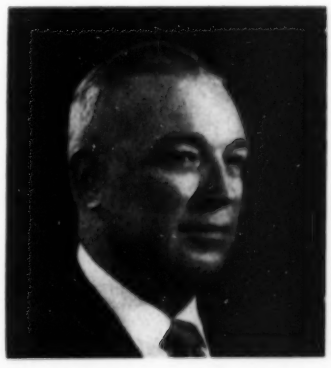
The high cost of butane vapor has, in the past, retarded the growth of the company's market. However, since natural gas was brought into the area last spring, the demand for service has increased many times over.

The market potential for natural gas in the area has become particularly evident since the anticipated changeover to natural gas.

The new corporation plans an accelerated expansion program that will take full advantage of this market potential and result in a system that will meet the area's recent population growth. A four-year expansion and rehabilitation program, supported by new financing and experienced personnel available with the new organization, is planned to bring the system abreast of its market by 1957.

Although the company is currently serving approximately four times the number of customers it served in 1948, it is significant in this connection that the major portion of the growth has taken place during the past year and a half. At the end of 1952 the company had slightly more than 1600 metered customers. This figure increased nearly 75% to more than 2800 customers by the end of 1953. The total number of customers now exceeds 4000.

An indication of the reason behind this growth, as well as an estimate of the market potential, may be had by reference to the city's population figures. In 1950 the city of Las Vegas had an official population of 24,624, an increase of 192.4% over its 1940 population. Recent estimates have given Las Vegas a population of 48,000. This makes Las Vegas the largest city in the state of Nevada; passing Reno, which showed a population gain of 52% during the 1940-1950 period.



Harold Laub, president of Nevada Southern and of Nevada Natural.

Although Las Vegas derives its major source of employment from entertainment and recreational activities characteristic of a resort area, employment aside from these categories shows a diversification among various industry groups such as mining, construction, business and personal services, wholesale and retail trade and related activities.

An important contribution to the economic growth of the area is Nellis Air Force Base, located at the north edge of the city, which has been classified as a permanent installation. An extensive housing project adjoins the air base. In addition, the government is now building a huge permanent ammunition depot in the vicinity of the air force installation which will also require substantial civilian and military personnel. A naval installation has recently been programmed. Another major economic factor is the Frenchman's Flat Atomic Energy Proving ground, northwest of Las Vegas.

The new company proposes to invest over $1.5 million in the installation of new mains and distribution facilities over the three years, 1954-1957. This is planned to accommodate an estimated 8200 additional customers to bring the total number of metered customers to about 12,000 by the end of 1957.

The present daily gas load taken from the Nevada Natural line averages nearly 1.5 MMcf. It is estimated that this average daily figure will increase to nearly 4.0 MMcf by 1957. Peak days are expected to reach 11 MMcf.

No significant conversion of existing users of electricity for space heating is contemplated for the present because current electric rates for the area are among the lowest in the country. However, shortage of power and higher costs resulting from construction of a new gas-fired steam generating plant required to augment the local power company's present supply, derived chiefly from Hoover dam, will probably require the electric utility to revise its rates upward. The new generating plant is scheduled for completion in December 1955 by Southern Nevada Power.

Operating experience with the Bureau of Mines dew point recorder

The natural gas industry has long recognized the need for a means of continuously measuring the water-vapor content of natural gas. Because of the human element present in the conventional hand-operated "spot-on-the-mirror" instrument, and because a continuous record of the amount of moisture present was desired, the recently developed Bureau of Mines hygrometer-actuated recorder* has been enthusiastically received. To date, the recorder's greatest value has been in determining the dryness of gas in pipelines—thus aiding in the prevention of harmful gas hydrates that form as a result of water in the gas—and in monitoring the change of cycles in dehydrating stations. In both applications it has proved useful in warning of faulty operation of equipment.

***See "Continuous Measurement of Water Vapor in Natural Gas Achieved with New Recorder" by W. M. Deaton, *GAS*, June 1953, page 100.**

1. General considerations on installation and calibration

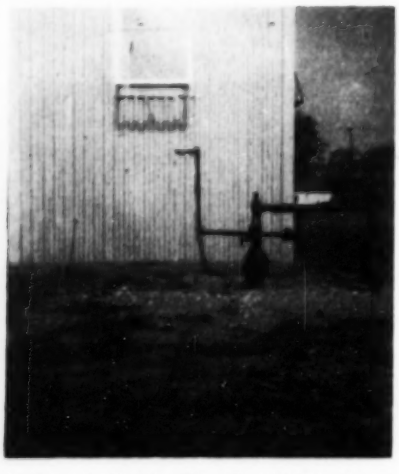
By J. R. BIRD • United Gas Pipe Line Co., Shreveport

THE United Gas Pipe Line Co. has at present 25 Bureau of Mines dew point recorders in service; 16 are located at dehydration plant outlets, being used for plant control, seven are set on certain long major lines, serving as a means of check and as a source of warning should high readings appear, and two are located at purchase points, maintaining a guide and record to contract water content requirements. These 25 recorders are monitoring 1.75 billion cu ft of gas per day, providing continuous data at each location.

Each recorder is housed in a building of 6 ft by 6 ft by 8 ft minimum dimensions (see *Fig. 1*). The building has a concrete floor, and is designed for at least one window and one door, and ample ventilation. The house is located as close as possible to the gas supply to prevent a long sample line (*Fig. 2*). Since the recorder is explosion-resistant but not explosion-proof, caution was observed to avoid installation in hazardous areas. Each recorder is on a separate circuit from the house lig to prevent service interruptions. T wiring from the outlet in the house the recorder is of heavy rubber-cove wire, or the wiring is installed in c duit, the recorder being well ground

In order to obtain the informat desired from the recorder, it is essen that the proper sensing element be lected so as to furnish the oper proof that the water vapor conten not exceeding some predeterm maximum limit. This is accomplis by selecting the element so that high range limit of the recorder ch is well beyond that required to reg this maximum. While this may re in the recorder registering zero w very dry gas is being received, suc sufficient evidence that the mois content of the gas is satisfactory. S the approximate pressure at which line is operating is usually known since the temperature of the gas sam being delivered to the sensing elem is controlled at a set temperature table can be used to show the rang the various elements. *Fig. 3* is suc table for pressures 500 to 900 psig for controlled temperatures of 80 and 100° F.

To illustrate the table's use, assu that an upper limit of 7 lb of w per million cubic feet has been es lished for a line operating at 700 p and ambient or flowing temperature quires a controlled temperature of F for the sensing element. The c shows that a Brown element give high chart range limit of 8.3 lb



A typical structure for housing recorder is seen in Fig. 1 (left). Fig. 2 (right) shows insulated sampling lines leading from the ground to recorder house.

million cubic feet and a low chart range limit of 2.0 lb per million cubic feet. If the operating pressure on the line were 900 psig, the upper limit of this sensing element would then be 7.0 lb of water per million cubic feet, so there would be no indication when the water content did exceed 7.0 lb of water per million cubic feet. Such a record could be obtained with the Brown element by increasing the controlled temperature of the gas sample to 100° F for a high range of 9.8 lb and a low range of 2.6 lb of water per million cubic feet, or by keeping the controlled temperature at 80° F and replacing the Brown element with a Red element, for a high range of 11.8 lb and a low range of 4.7 lb of water per million cubic feet.

In attempting to simplify the reading of the recorder, a chart was prepared whereby the operator could obtain a reading directly as pounds of water per million cubic feet or as dew point temperature. This chart is a 0-100 scale for a certain sensing element at a known controlled temperature, imposed on a reliable "pounds of water versus dew point temperature chart." In illustrating its use, assume the recorder is operating with a Brown element, 80° F controlled temperature, 700 psig line pressure and a recorded scale reading of 60. By referring to the prepared chart *(Fig. 4)*, locate the recorded reading "60" on the 0-100 scale at the bottom of the chart and then follow the line vertically to the 700-psig line, then from this intersection, follow the horizontal line to the left to find the water content to be 4.3 lb; or, if the dew point temperature is required, then read directly below the reading of 60, which shows the dew

HIGH AND LOW LIMITS ON 0-100 CHART READINGS
FOR VARIOUS SENSING CELLS AT 80° AND 100°F

Cell	80°F Controlled Temp. (D.F. Temp. Limits) Low	High	100°F Controlled Temp. (D.F. Temp. Limits) Low	High
White	-20°	+11°	-9°	+20°
Black	-12½°	+15°	-4°	+26°
Brown	-5°	+30°	+5°	+40°
Red	+20°	+45°	+32½°	+57½°

POUNDS OF H_2O PER MMCF LIMITS AT VARIOUS PRESS.

	PSIG	80° Low	80° High	100° Low	100° High
White Cell	500	1.3	4.9	2.2	7.3
	600	1.1	4.3	1.9	6.4
	700	Less than 1 lb	3.8	1.6	5.6
	800	Less than 1 lb	3.4	1.5	5.1
	900	Less than 1 lb	3.1	1.4	4.7
Black Cell	500	1.85	6.0	2.7	9.0
	600	1.6	5.3	2.3	7.9
	700	1.4	4.6	2.1	7.0
	800	1.3	4.2	1.85	6.4
	900	1.2	3.9	1.7	5.7
Brown Cell	500	2.6	10.8	4.0	15.5
	600	2.3	9.5	3.5	13.2
	700	2.0	8.3	3.2	11.8
	800	1.8	7.6	2.8	10.8
	900	1.7	7.0	2.6	9.8
Red Cell	500	7.4	18.5	11.5	28.5
	600	6.4	15.8	10.0	24.0
	700	5.6	14.0	9.0	22.0
	800	5.1	12.8	8.2	20.0
	900	4.7	11.8	7.6	18.0

Fig. 3. The table at right shows the range of various sensing elements used with the dew point recorder.

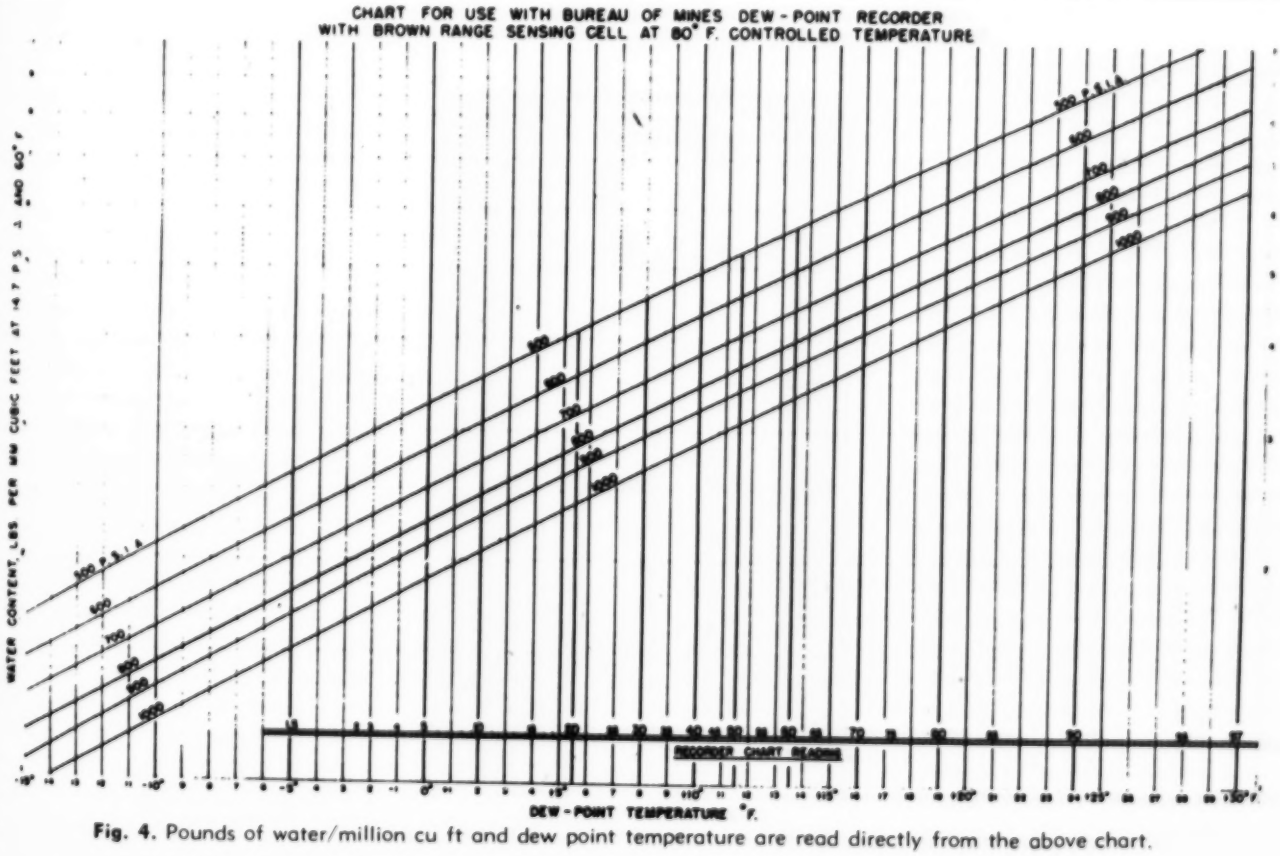


CHART FOR USE WITH BUREAU OF MINES DEW-POINT RECORDER
WITH BROWN RANGE SENSING CELL AT 80° F. CONTROLLED TEMPERATURE
WATER CONTENT, LBS PER MM CUBIC FEET AT 14.7 P.S.I.A. AND 60° F
RECORDER CHART READING
DEW-POINT TEMPERATURE °F.

Fig. 4. Pounds of water/million cu ft and dew point temperature are read directly from the above chart.

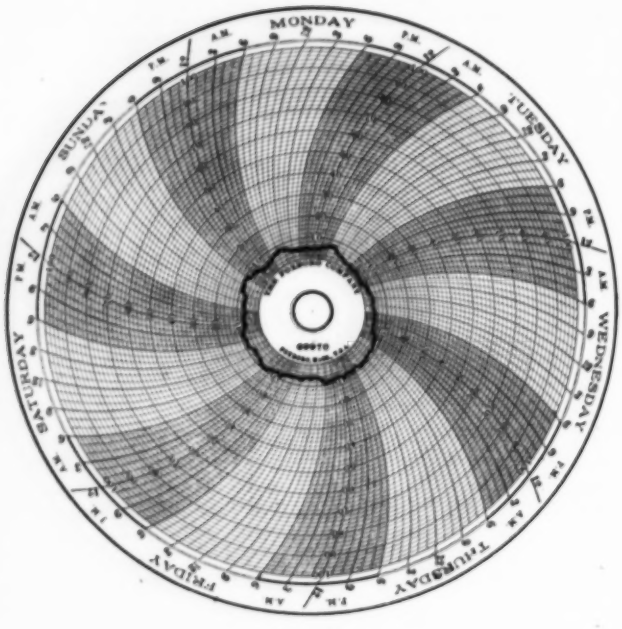


Fig. 5.

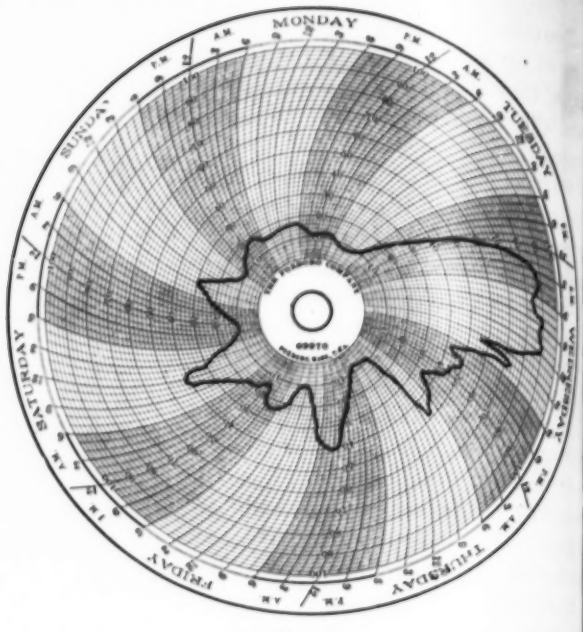


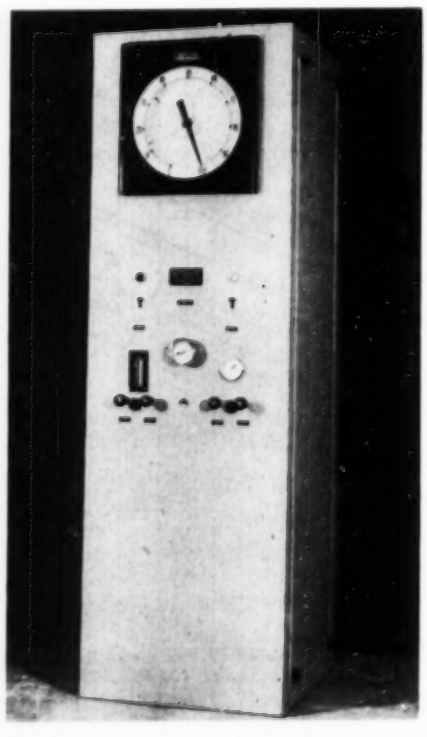
Fig. 6.

point temperature to be + 13° F.

Several charts, which are actual recordings on pipelines, are exhibited to illustrate the importance of continuous measurement of the water vapor content. The first chart *(Fig. 5)* demonstrates a week of excellent conditions of this line, the operating pressure being 550 to 600 psig; and the recorder reading being between 2 and 10, such representing a control of between 2.7 lb and 3.2 lb of water per million cubic feet. *Fig. 6* demonstrates the approach of the maximum allowable conditions: Beginning at 7 p.m. on Tuesday, there began an increase, which by 2 a.m. on Wednesday had reached 7 lb of water per million cubic feet. The high moisture content was rectified at the input and a satisfactory condition was obtained by 12 noon of Wednesday.

The company's instrument men visit the dew point recorders regularly once a month; they are called to make trouble-shooting trips between these regular inspections. Replacement parts for 25 recorders for a period of one year have been: two transformers, one relay, two thermoregulators and approximately 50 vacuum tubes. The majority of the tube failures were the new smaller type tubes, the 12AU7 and the 12AX7. The instrument manufacturer has determined that these tubes were overloaded, and has recommended the installation of a selenium rectifier and resistor in the amplifying unit. These parts are furnished as a kit number 359648 on request.

There was one early case of trouble which gave some concern, where the recorder pen, for no obvious reason, started wandering aimlessly over the chart. It was finally noticed that this occurred when the "cooling gas" tubing was sweating excessively; the dripping condensation causing a short in the circuit between the sensing element and the potentiometer. This difficulty was solved by installing a plastic shield, furnished by the manufacturer, on the hexagon plug containing the connector between the sensing element and the potentiometer.



The Bureau of Mines dew point recorder.

Another case of trouble experienced was when the "flow-rate" valve, which is operated in a throttled position, froze during the high peak of water vapor which immediately followed switching to a regenerated contactor. This was solved by applying heat to the "flow-rate" valve.

At a vital junction of two large feeder lines, each having several major points, it was advisable to keep a close watch on each leg before the total mixture began its long haul in the connected mainline. Since the personnel at this junction could not watch the recorder at its location nor switch the sample lines for checking the two legs and the mixture, a dew point recorder was installed, equipped with a Bristol potentiometer which had an integrally mounted Bristol Metameter transmitter, sending the values to a recording receiver located on an instrument panel in front of a station operator some distance away from the recorder; and a 3-way program-timer assembly was devised for automatically switching the sample lines at set intervals.

In 1952, there were six dehydration plants ready to be placed in service for which the dew point recorders had not been received, so one available recorder was dispatched by truck from plant to plant, remaining at each plant until it met its acceptance test. It took more than three months and 2000 hard miles before this recorder was back in service at its original location, the recorder showing no ill effects from such handling.

2. The dew point recorder in dehydration plant operation

By W. L. YAUGER • United Gas Pipe Line Co., Shreveport

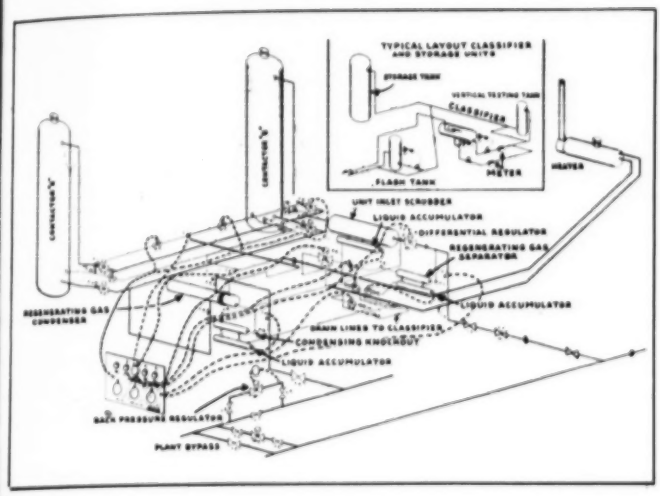


Fig. 7. Schematic diagram of a typical solid desiccant dehydration plant.

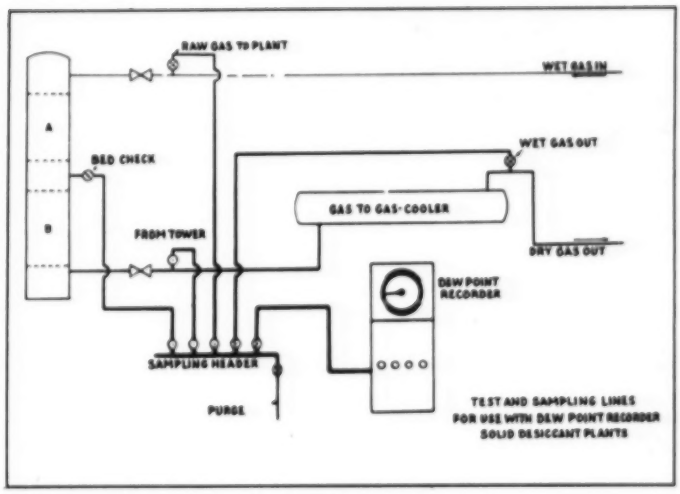


Fig. 8. Diagram of the "hook-up" for the dew point recorder.

THE United Gas Pipe Line Co. recently constructed an extensive system of 30-in. transmission lines for the transportation of huge quantities of gas which had to meet rigid specifications as to water content. Along with the construction of the new pipeline, new dehydration plants were being installed at the field ends of the lines. These were designed for regulating the amount of water vapor in the gas so that it met the specifications required for transportation in the new system, and improving the quality of the gas furnished to the older systems. The gas thus furnished at the field ends of the lines had to meet all requirements, since further dehydration along the transmission system was not then contemplated.

As the result of this new construction, it was necessary to put 25 individual dehydration units in 11 locations into operation almost simultaneously. The crews for manning these plants were composed largely of men as yet inexperienced in dehydration plant operation, and particularly so in the use of the conventional hand-operated mirror type dew point apparatus. The problem existing was hence complicated by both new plants and inexperienced men.

A preliminary job training program was instituted, which to a large extent solved the problem. The plants were started on schedule and during the break in and seasoning period were properly handled. Gas of the required specifications was furnished as contracted for.

The company's present dehydration plant capacity is 2.5 billion cu ft per day. The daily average delivery of dehydrated gas is approximately 1.75 billion cu ft.

From these figures it is apparent that an accurate and rapid method for determining dew points at all times was necessary, and this method could not depend to a large extent on experienced personnel. The company therefore welcomed the dew point recorder when it was made available.

Shown in *Fig.* 7 is a typical solid desiccant dehydration plant. One or more of these self-contained units is installed at each location, as needed. The design is based on a maximum working pressure of 1000 psig and 95° F flowing gas temperature. In this so-called automatic plant the towers and regeneration systems are switched by the time cycle controller. Its operation requires a minimum of attention from the operator, his main duty being to see that the plant remains in good order and to put into or remove from service the number of units needed to meet the load requirements.

The heavy line indicates the flow of the gas being dehydrated. The light line indicates the regeneration cycle on the saturated tower. The automatic equipment switches towers at the end of each cycle so that dehydration of the main stream is continuous.

Fig. 8 shows the schematic diagram of the "hook up" for the dew point recorder. These connections are made to a sampling header located near the instrument. In this way, if it is desired to check the various functions of the plant, it is easy to do so by merely opening the proper valves to introduce the gas into the instrument for dew point determination.

It is recommended that as small a line as possible be used in the sampling system so that an immediate response from the instrument can be obtained when any change occurs in the dew point of the gas being tested. One-quarter-inch copper tubing is suitable.

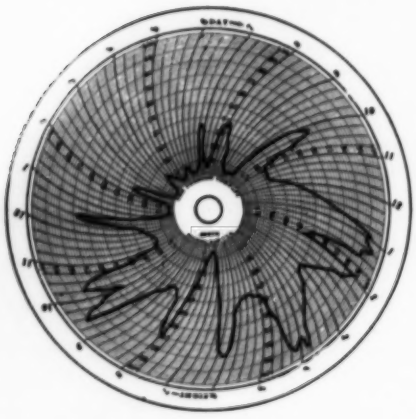


Fig. 9. Erratic dew point readings, as those shown above, may be studied and compared by means of a dew point recorder.

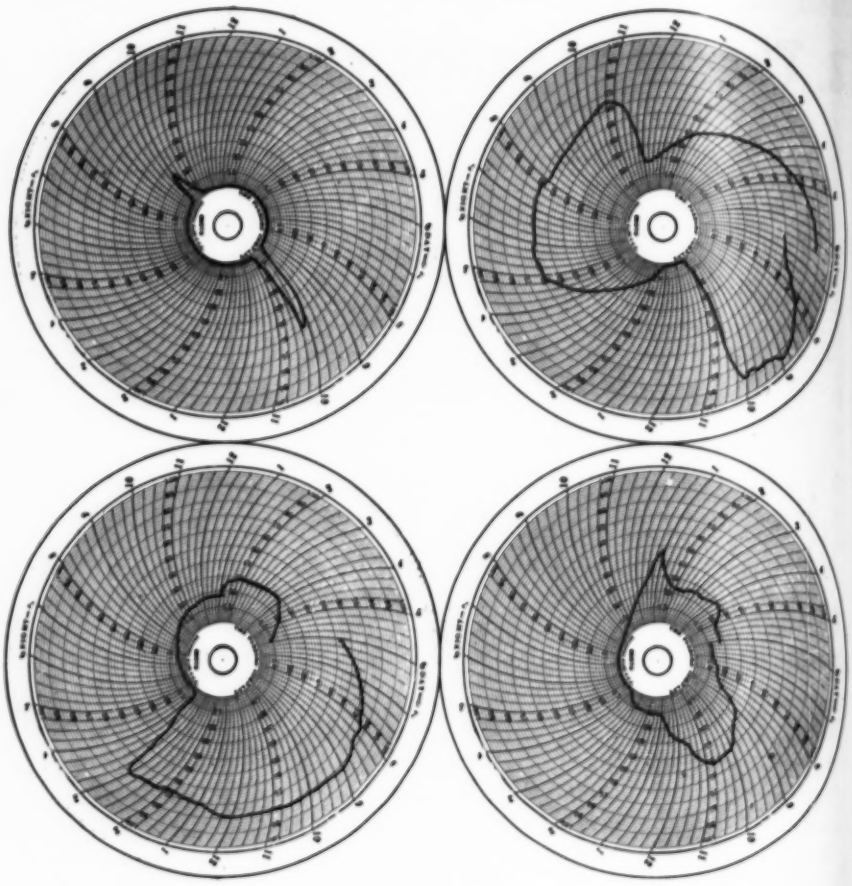


Fig. 10. The history of the development of leaking valves is graphically illustrated at right. (Sequence is upper left, upper right, lower left, lower right.)

Care must be exercised in preventing condensation in the sample lines in areas with low ambient temperatures. It might be suggested that the instrument be so located that sample lines are kept as short as possible. Sample lines may be insulated at shown in *Fig. 2*. Or, sample lines may be buried, if possible, below the frost line. If this latter measure is taken, it is important that no liquid traps are left in the lines. This may require taking a surplus bleed of gas from below the ground level before the sample line rises to the instrument.

This system gives the operator the opportunity to observe the performance of each bed in a multi-bed unit, to check the operation of the "cooler-condenser" for leaks of water back into the dry gas stream, and to check the overall efficiency of the individual tower or the unit as a whole. All of this can be done without disturbing the overall plant operation.

The sample line shown to the wet gas side of the plant enables the operator, by admitting into the sampling header small quantities of wet gas, to establish a dew point on the recorder, which he can then check by means of the mirror type Bureau of Mines apparatus to assure himself of the accuracy of the recorder and to check it for "sensing cell" calibration. In this case a "Brown call," which does not show dew point of less than 2 lb of water per million cubic feet at operating pressures, was used. Therefore, the instrument generally remains at zero on the chart for long periods of time. In order to check the instrument the operator can create a known dew point for test purposes.

Figs. 9 and *10* show records of performance that clearly illustrate the value of the recorder to the dehydration plant operator.

Almost everyone who has taken dew point readings will agree that at times it is almost impossible to get satisfactory readings by means of the conventional hand-operated instrument. For example, suppose that dew points of the effluent from a plant are being determined by various people from hour to hour. One man may report a dew point of 3 lb of water per million cubic feet, and an hour later another man, or the same man, may report a dew point of 8 lb. After several such variant reports one begins to wonder if those men know a dew point when they see it, and is curious as to what the water content of the gas really is.

The chart in *Fig. 9* shows that in such a case all the men could have been right in the dew points they reported. From this chart one notes that the actual dew point may change very rapidly, this change occurring in a matter of minutes. This particular chart was taken of a plant that was working at overload conditions, and considerable trouble was being experienced with some of the desiccant beds.

Fig. 10 shows graphically the history of the development of leaking valves in an operating unit. The chart on the left shows that valves on each of the towers have begun to leak. The second chart shows that the valve on one tower has begun to leak much worse than the other. The third chart shows that now both valves are very bad. The fourth chart shows typical unit operation after repairs were made. The small "kicks" shown represent points at which tower cycle switching occurs.

Fig. 11 shows the case of a leaking condenser. The chart at the top indicates the water content record of the gas leaving the plant. The bottom chart shows the water content of the

cooling gas to the condenser from the drying tower. Water content of the gas leaving the plant was 5.5 lb per million cubic feet. The average water content to the cooler was 2.8 lb per million cubic feet.

The tube bundle was pulled from the cooler-condenser, and two tubes were found to be leaking. Repairs were made and the plant was returned to operation in a short time.

It might be pointed out here that the advantage of having the recorder at the plant hooked up in the manner previously described is that the operator is able to rapidly check and isolate the various causes of trouble, resulting in the shortest possible off-stream time for the plant when repairs are made.

The recorder has been very useful for seasoning or breaking in new desiccant beds. It has been the company's practice to saturate the new bed very slowly to full water saturation and then to regenerate at an equally slow rate until the bed has become completely dry (bed temperature is between 350° and 375° F). This process of seasoning is repeated several times until the beds have been reduced in their water sensitivity. The recorder indicates when the "break point" has been reached so that the operator can then switch beds and proceed with the regeneration functions.

Again, as noted on the schematic diagram earlier, the performance of an individual bed in a multi-bed tower can be noted and the break point determined along with the amount of gas treated to determine the efficiency of any particular bed or desiccant.

Fig. 12 shows what a good chart looks like. The recorder pen in this case remained at zero except during the period of tower change. The "kicks" shown indicate that the recorder is working and the interval of the kicks shows that all valves are closing properly and that the plant, as a whole, is in satisfactory operating condition.

In conclusion, it might be pointed out that the company does nothing with the recording instrument that could not be done with the hand-operated instrument, but we do find that a continuous record of dew point is desirable. The instrument as installed is convenient to operate and the results reported do not depend upon a spot on a mirror that an operator saw, or thought he saw, when making a determination under adverse light and weather conditions.

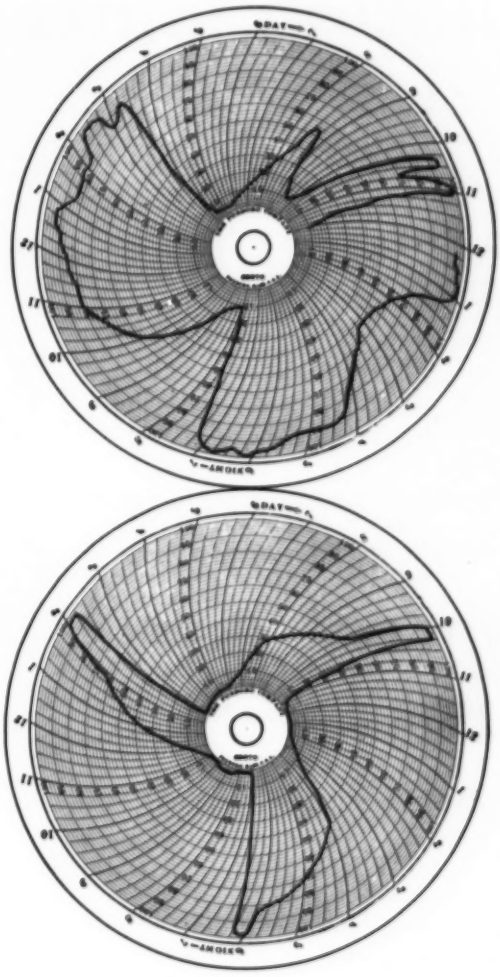


Fig. 11. Graphic representation of a leaking condenser. Chart at top shows water content record of gas leaving the plant. Lower chart indicates water content of cooling gas to the condenser.

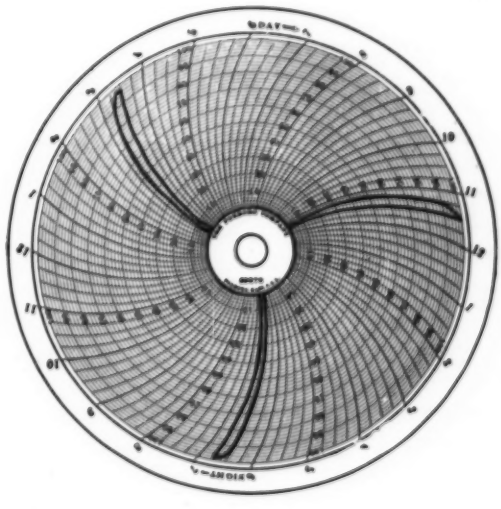


Fig. 12. Ideal operation of a dehydration tower is indicated by the above chart.

Insulating joints in long pipelines

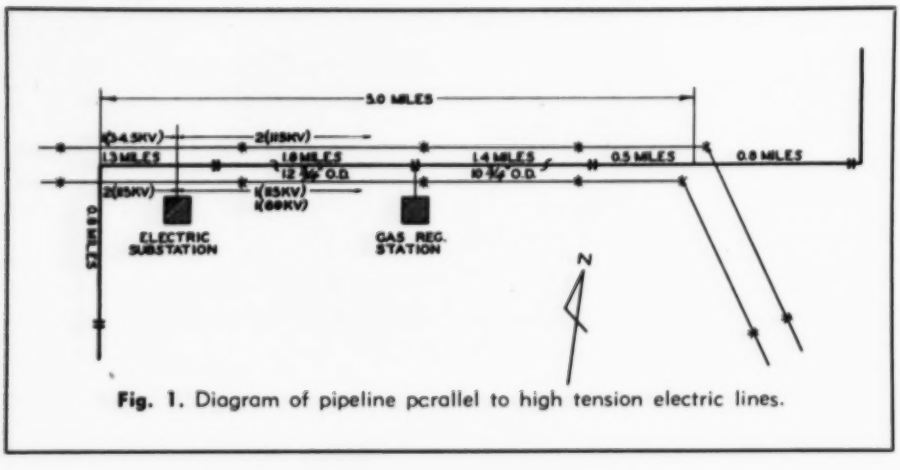


Fig. 1. Diagram of pipeline pcrallel to high tension electric lines.

Part 5. Electrical effects on underground pipelines

By **JOSEPH P. DARATT** • Niagara Mohawk Power Corp., Syracuse

THE ever increasing difficulties of obtaining rights-of-way for gas lines operating at elevated pressures, which were required to bolster older gas distribution systems being subjected to heavy demand during the heating season, has made it necessary for Niagara Mohawk Power Corp. to construct some of these feed lines partly on rights-of-way, owned in fee or by easement, originally acquired for high tension electric transmission lines. One of these gas-feed lines, in part along high tension lines, was installed in 1952 using steel pipe, coated with coal tar enamel, glass and an outer wrap of asbestos felt, with underground flanged valves, one flange of which was insulated.

It was soon apparent that induced alternating current was present on this line as evidenced by personnel being subjected to mild shocks when operating valves and by arcing across a pressure-test pipe and its enclosing roadway box. The line involved parallels high tension electric lines for approximately five miles. One section of about 1.3 miles lies between a steel tower line with two 115-kv circuits and a wood pole line with one 34.5-kv circuit, and the balance, some 3.7 miles, lies between two steel tower lines, one with two 115-kv circuits and one with one 115-kv circuit and one 69-kv circuit. The steel tower lines are equipped with an overhead ground wire and a counterpoise system. *Fig. 1* shows this five-mile area and pertinent locational information.

Normal operation

Tests made along this gas line indicated that a fairly uniform resistance of approximately 1.5 ohms existed between the counterpoise system and the pipeline. In a series of readings of the induced current flow between the pipe and the counterpoise system, the majority were in the magnitude of approximately 2 amps and the highest reading indicated 10 amps at 15 volts. Further readings taken pipe-to-pipe showed, in general, a higher current flow averaging approximately 4 amps and the highest indicated was 7.8 amps at 11 volts.

The field data accumulated to date are far from conclusive and must be followed up over a longer period of time before a satisfactory conclusion can be reached. The pipe-to-pipe readings indicated that as the pipeline diverged from the electric right-of-way at each end of the five-mile section, the flow of current gradually decreased in magnitude to less than 1 amp. Beyond the insulated joints, some .8 of a mile removed from the electric line, the current flow, if any, was not measurable.

The insulated joints along this pipeline are close together because valves to serve a bridge crossing and a railroad crossing were necessary. This close spacing helps in lowering the induced voltage per section.

Abnormal operation

There has been recorded on the electric lines involved a phase-to-ground fault of approximately 4500 amps. It is not inconceivable that this might result in a potential rise that could cause a breakdown in the insulating material in the joint. After one year of operation, without arresters across the flanges, one insulated flange of the five shown on *Fig. 1* may have failed as indicated by equal electrical measurements on each side of the flange. There is some doubt as to the failure of the joint, since the equal electrical readings could be caused by equal induced voltage in the adjacent sections of the pipeline.

Conclusion

Where it is necessary to construct a pipeline along a high tension line, and it is our opinion this should be held to a minimum, two protective measures should be taken:

1. Protection of personnel
2. Protection of insulated joints

Consideration of personal safety should be the primary consideration. A ground grid in the working area of valves and associated accessories is a feasible method of keeping personnel at the same potential as the pipeline while operating valves, and thus mitigating possible injury. *Fig. 2* shows such a grid, which we are using in the Syracuse area.

Proper protection of insulated joints against high voltage surges is still open for improvement. At the present time

This is the fifth and concluding part of a series of articles adapted from a panel discussion presented at the AGA distribution conference in April.

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we are installing a spark or spill type arrester with three gaps: one gap across the insulated joint, and one from each side of the joint to ground, the latter gaps being smaller than the gap across the joint.

Arresters presently available all have one common defect in that they require constant vigilance and maintenance to insure that the device is in working order when needed and, in general, discharge at too high voltage. This maintenance can become a burdensome expense. It would appear that this field is ripe for research and invention.

Frequency of insulated joints

The spacing of insulated joints on coated lines is dependent upon the type of soil, soil resistivity, pH values and other physical factors in the area in which the pipe is installed. The area south of Syracuse is rather rugged in contour; in general the soil is of a highly alkaline limestone type with a heavy concentration of calcium salts and a pH in the range of 9. Quick changes in soil resistivity are common between bottom lands having a soil resistivity of about 1700 ohms per cubic centimeter and hill tops, less than one-half mile distant, with a soil resistivity of about 34,500 ohms per cubic centimeter. Past experience has taught us that the area where abrupt changes take place between soils of low resistivity and soils of high resistivity is the area in which corrosion is most active. Therefore, we attempt to isolate these sections of low resistivity and because of this some of our insulated joints are only about a mile apart.

North of Syracuse the land is much less rugged and the soil is of a sandy nature having a high resistivity, which, in the route of a 50-mile pipeline installed in 1953, was fairly uniform at around 23,000 ohms per cubic centimeter, with a tendency to increase slightly toward the northernmost end.

On this line insulating joints were installed at the take-off valve sites for some seven villages which were passed enroute. These joints were installed aboveground, varying from 4 miles to 7.5 miles apart, and could have been farther apart with good results. The four-mile section is amply protected by two 15-lb magnesium anodes and the most northerly 7.5-mile section is protected by dc from a telemetric system that has a ground return. This condition was discovered when the routine coating resistivity test was made in August 1953, after the pipeline was completed. It is certainly not our intention to rely upon this protection indefinitely and it is mentioned here merely as a matter of interest.

Flange type insulating joints

Insulated joints of the flange type are in general use on high pressure gas lines mainly because of their mechanical strength. They are, however, subject to deterioration in insulating value from high voltage surges, mill scale bridging across the insulating material in the joint, internal moisture, bolt sleeve fracture, and current leakage around the flange due to break-down of external coating.

Experience has indicated that using one flange at a valve for an insulated joint is not satisfactory because, in larger size valves at least, it requires field assembly, which is always problematical as to quality, and it also involve difficulties in applying the necessary coating. A separate set of flanges installed underground can be more easily and better protected against external moisture. A flange-type insulated joint above ground, where possible, is desirable.

A policy of fabricating insulating joints in a shop with skilled men will pay off in joint quality. Nipples at least 3 ft long should be welded to the flanges before assembly, considerable care being taken in drawing up the bolts uniformly and the initial coating applied.

To mitigate the problems of mill scale bridging across the flanges or moisture setting up a leakage path, two methods have been tried in our area. One is to coat the flange joint internally, after assembly, with liquid neoprene and the other the use of an insulating gasket having a smaller internal diameter than the pipe. Not feeling satisfied that these methods offer a cure, our specifications now call for aboveground installation in a vertical position wherever possible. This type of installation will, we feel, allow mill scale and moisture to drop past the flange and thus partially alleviate possible break-down of insulating joints due to these causes.

An experiment now in progress using a flanged spool piece coated internally and externally, as well as on the face of the flanges, with a rubber compound, appears at this time to offer a decided improvement over the conventional insulated flange joint. Field testing is not completed at this time so no real conclusion can be made.

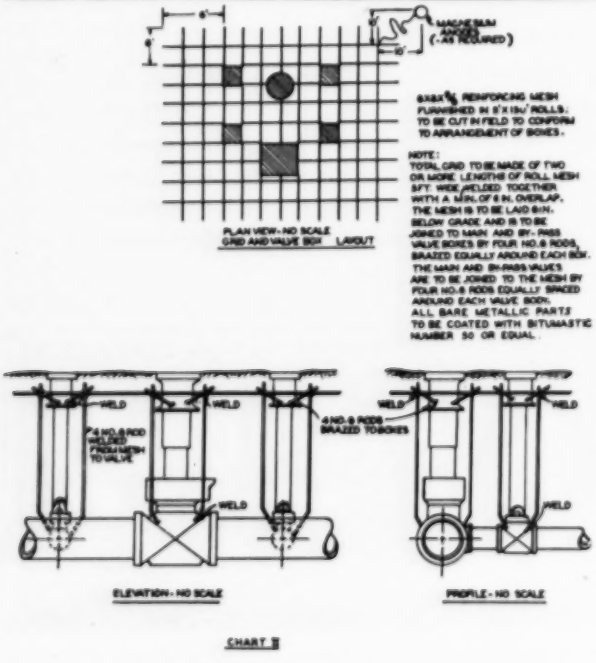
MAGNESIUM ANODES (2 REQUIRED)
6x6x6 REINFORCING MESH FURNISHED IN 5' X 150' ROLLS. TO BE CUT IN FIELD TO CONFORM TO ARRANGEMENT OF BONES.
NOTE:
TOTAL GRID TO BE MADE OF TWO OR MORE LENGTHS OF ROLL MESH 5FT. WIDE WELDED TOGETHER WITH A MIN. OF 6 IN. OVERLAP.
THE MESH IS TO BE LAID 6 IN. BELOW GRADE AND IS TO BE JOINED TO MAIN AND BY-PASS VALVE BOXES BY FOUR NO. 6 RODS, BRAZED EQUALLY AROUND EACH BOX.
THE MAIN AND BY-PASS VALVES ARE TO BE JOINED TO THE MESH BY FOUR NO. 6 RODS EQUALLY SPACED AROUND EACH VALVE BODY.
ALL BARE METALLIC PARTS TO BE COATED WITH BITUMASTIC NUMBER 50 OR EQUAL.
PLAN VIEW - NO SCALE
GRID AND VALVE BOX LAYOUT
WELD
4 NO. 6 RODS WELDED FROM MESH TO VALVE
4 NO. 6 RODS BRAZED TO BOXES
ELEVATION - NO SCALE
PROFILE - NO SCALE
CHART 3

Fig. 2. Typical ground potential grid being used in the Syracuse area.

Summary

Insulated joints are desirable where cathodic protection is used and especially if the line protected is exposed to induced alternating current, in which event protection of personnel is of prime importance. Protection of insulated joints against high voltage surges, either on pipelines through open country or along high tension lines, is necessary but present devices should be improved to cut down maintenance costs. Spacing of insulated joints is dependent upon location of the pipeline, type of soil encountered, soil resistivity and other physical factors. In general, closer spacing is desirable where pipeline parallels a high tension electric line.

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Anticipating a relatively short life for the field, Arkansas Louisiana Gas specified that Beaird design the unit to meet a wide range of operating conditions. The flexibility of this design will permit the unit to be moved without change, to other service. Completely assembled and mounted on its own steel base it required a minimum in the way of permanent foundation and connecting piping. This feature makes the installation almost wholly salvageable when moved.

Pioneers and leaders in the development of packaged compressor plants — Beaird offers you proven equipment with an outstanding record of successful operation over a wide range of service.

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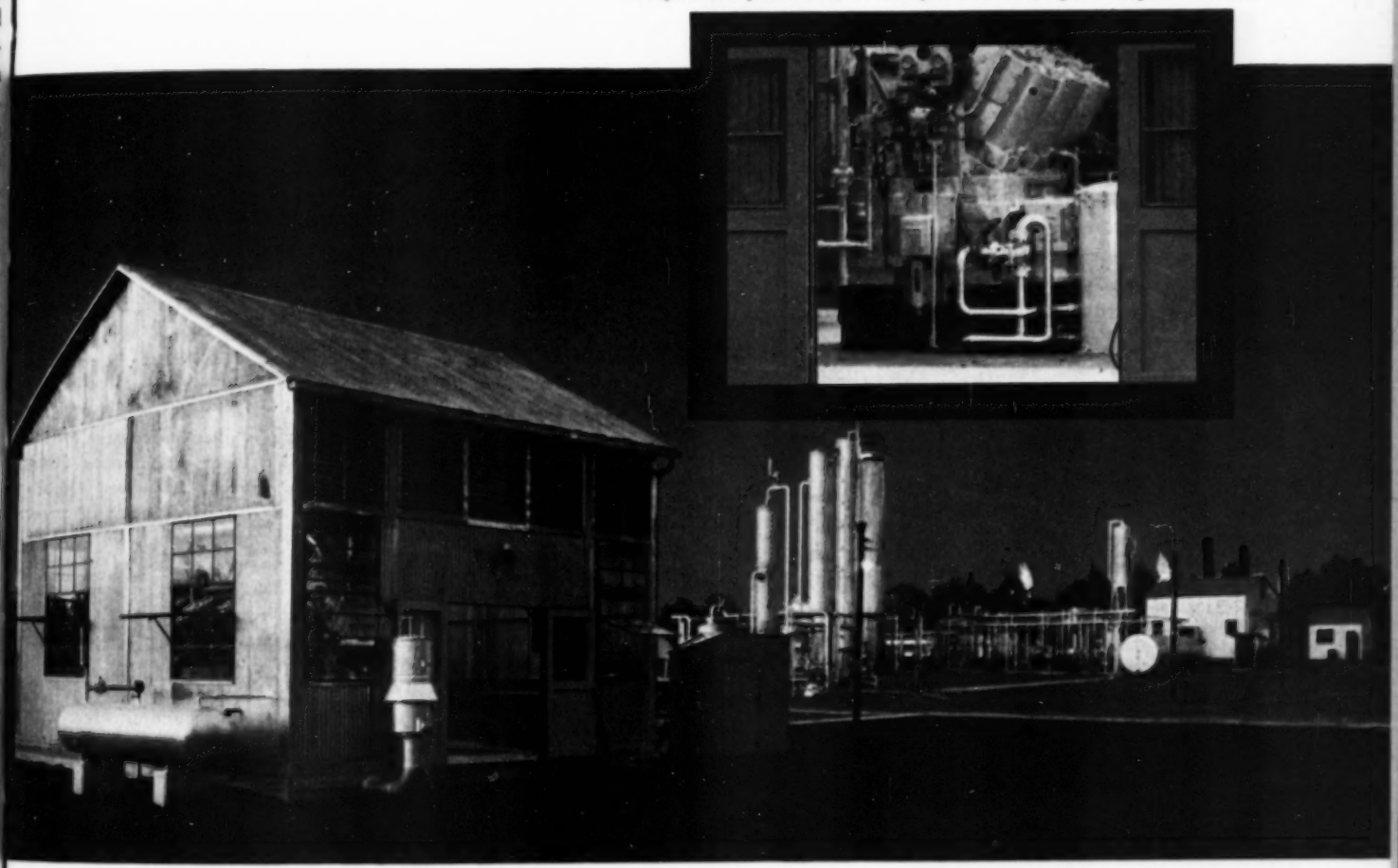

Arkansas-Louisiana-Gas Company's Smithland, Texas, packaged compressor plant — equipped with an Ingersoll-Rand 330 h.p. 6SVG gas engine driven compressor, Young radiator and all necessary equipment and controls. Other sizes 110 h.p. to 660 h.p. The steel deck has been mounted flush with the flooring at the option of the purchaser.

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LP-GAS SYSTEMS

Pipeline Communications and Electronics

By FRANK CHAPMAN

"Snow Buggy" aids microwave station maintenance

YEAR-ROUND access to microwave repeater stations located in mountainous country has been made easier for El Paso (Texas) Natural Gas Co. communications engineers by a vehicle devised specially for this purpose by F. E. Bower, the company's Northern division engineer.

The vehicle, known as a "snow buggy," is made from a standard Cletrac tractor fitted with wide track-type treads. The treads, one of which encircles all four wheels on each side of the tractor, is made up of steel plates held in place with wooden cleats (see *Fig. 1*). The tires are exposed between the metal plates and drive against the wooden cleats. The drive is from the rear wheels with the front wheels acting as idlers.

The snow buggy has no difficulty in traveling over heavily snow-covered roads in mountainous regions, and on steep mountain grades in wet and muddy weather. It has been used to reach mountain top microwave station locations during weather conditions that would not permit the use of either trucks or jeeps.

For the comfort of maintenance personnel a specially constructed cab is mounted over the driver's seat as protection against weather. Both the cab and the tread were made in the company's machine shop at Farmington, N. M., headquarters for the Northern division.

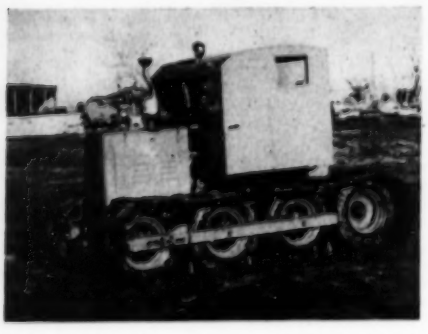


Fig. 1. The "Snow Buggy," devised and built by El Paso Natural communications engineers for use in servicing mountain top microwave repeater stations.

Fig. 2. Some indication of the kind of country over which communications men must travel to service microwave repeater stations is shown in this photo of El Paso Natural's station atop Hualpai peak. El Paso's microwave circuit, engineered and installed by Philco Corp., spans some of the country's most rugged terrain.

A vehicle of this kind is particularly useful in Mr. Bower's Northern division because the microwave circuit through the area for which he is responsible spans some of the country's most rugged terrain (see *Fig. 2*). Although jeeps and other lighter vehicles may be used for maintenance in the summer months, access roads—or trails, as they might more properly be called—are not in condition for the use of such transportation during considerable portions of the winter and spring months.

SGA holds communications round table

The annual communications round-table conference of the Southern Gas Assn. was held in Dallas at the Adolphus hotel on July 15. Twenty-nine in attendance representing 19 member companies participated in the discussions. Subjects discussed included problems of operating and maintaining VHF radio and microwave, problems of the industry concerning rules and regulations of the Federal Communications Commission, and the training and selection of personnel for communication departments of gas companies.

Conference chairman was C. E. Upson, general superintendent of communications, Texas Illinois Natural Gas Pipeline Co., Chicago.

Motorola appoints regional manager

Donald F. Brickley has been named manager of Region 1 of Motorola Communications & Electronics Inc., covering the states of Idaho, Montana, eastern Nevada, Washington, Wyoming and Utah. Before taking over direction of Motorola's sales activities in the Pacific Northwest, Mr. Brickley for four years was the company's zone manager in northern Illinois.

With appointment of Mr. Brickley as regional manager, the regional headquarters formerly located in San Mateo, Calif., will be moved to Portland Ore. Northern California, which previously was in Region 1, will now be served by the Motorola regional headquarters in Los Angeles. This realignment of regional activities will insure improved service to users of Motorola communications equipment in the fast-growing Northwest and West coast areas. The Motorola Parts and Service Depot serving both areas will continue to function out of San Mateo.

New field battery charger

A new regulated battery charger, designed primarily for utility work trucks equipped with 2-way radio and other accessories requiring a 6-volt d.c. power supply, has been announced by D. W. Onan & Sons Inc., of Minneapolis.

The charger is intended for use in the field where it is often necessary for 2-way radio equipped vehicles to keep engines idling while off the road work is being done. The unit draws its a.c. input from an Onan a.c. electric generating plant. It may be used to charge the 6-volt storage battery and provide up to 25 amperes for powering radio equipment before any demand is made on the battery.

The unit can also be used in any garage, service station or other building where 110-125 volt, 60-cycle current is available.

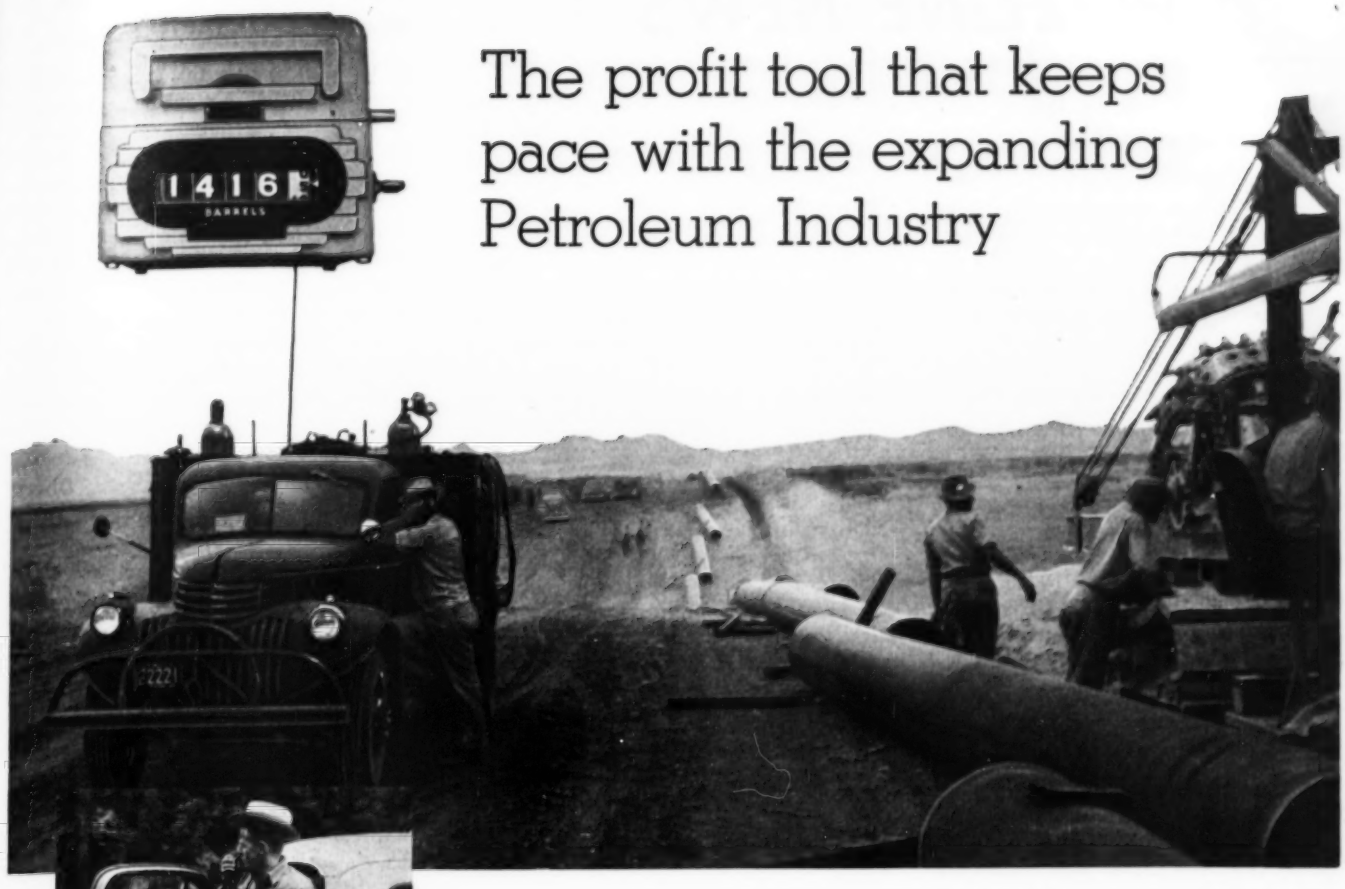
Recent FCC authorizations

Ohio Fuel Gas Co., Columbus, for one base station at Mt. Vernon on 33.53 mc.

El Paso (Texas) Natural Gas Co., for one base station at Ignacio, Colo., on 48.74 mc.

Gulf Interstate Gas Co., Houston, for two base stations at Corinth, Miss., on 49.72 mc. and 48.72 mc.

The profit tool that keeps pace with the expanding Petroleum Industry



On a remote strip of pipeline, a road superintendent exchanges some critical information with his spread foreman some 22 miles away saving several hours delay of another complete work unit.

Alert dispatcher "quarterbacks" important movements far and wide while his hourly record shows proof of tremendous accumulated savings in time, equipment, fuel and customer good will.

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PIPELINE NEWS

Mississippi river to be spanned by pipeline

American Bridge division of U. S. Steel Corp. was scheduled to begin erection about Aug. 1 of the steel superstructure for a natural gas pipeline suspension bridge with the longest main span in the world across the Mississippi river, 80 miles north of Cairo, Ill.

The 3690-ft bridge with a main span of 2150 ft is being built for the Texas Illinois Natural Gas Pipeline Co., Chicago, at a cost of $3.8 million. It will supplement the company's present underwater lines, and thus eliminate the danger of service interruption due to hazardous currents of the Mississippi river.

Two 30-in. pipelines will be laid from two steel framework towers, one on the Illinois side and the other on the Missouri side, near Wittenburg, Mo. Some 1300 tons of structural steel and wire rope will be used. The steel is being fabricated at the Gary, Ind., plant of American Bridge and the wire rope, to be used in the cables, comes from U. S. Steel's American Steel & Wire division in Trenton, N. J.

This will be the first suspension pipeline crossing of the Mississippi river. Steelwork is expected to take about six months with the pipeline going into operation in early 1955. Work began in October 1953.

An idea of the magnitude of the construction may be gained from the fact that the pipe alone weighs in excess of 563,000 lb, in addition to the massive weight of towers and cables involved in the structure. Pipe already is piled high on the Missouri side, waiting to be set into place.

The project is divided into three work divisions: foundation, superstructure, and pipe laying. It's an engineering axiom that heavy construction must have a firm foundation, and that's the job of work crews now installing bases for the two steel towers. The towers will be 246 ft high.

The foundation work will consume about 14,000 cu yd of concrete or roughly 88 loaded railway cars. A concrete and steel foundation reaching 141 ft has been dug on the Missouri side. It's an easier job on the Illinois side where the foundation bites into solid rock at about 40 ft.

Sitting back from the pier bases are two anchor sites, one on each side of the river. The anchorages are to secure the ends of the main cables. The two anchorages are 3690 ft apart, representing in a sense the total cable span of the bridge.

The two steel towers, one on each main pier, will be the first steelwork to go up. When the towers are completed, the main cables will be strung across the river. Each main cable consists of a mass of 12 2-in. wireropes, which will be strung across the river separately, and then clamped together to form one of the twin main cables.

The main cables will be the primary support of the pipeline. Suspending lines will drop from the main cables to hold a steel cradle which will further support the pipe.

The steel cradle will do just that, forming a cradle for the twin pipeline.

Texas Illinois has three suspension bridge river crossings—over the Colorado river and Brazos river in Texas and the Red river in Arkansas. The longest main span for a pipeline suspension bridge up until now has been the Transcontinental Gas Pipeline Corp.'s 2000-ft pipeline bridge across the Atchafalaya river near Melville, La.

TGT and producing firm merger anticipated

A shift in strategy that is reportedly motivated by the change in the regulatory atmosphere for gas transmission companies is the anticipated merger of Tennessee Production Co. into Tennessee Gas Transmission Co., which owns about 49% of the production company's outstanding common stock. A merger proposal is expected this month that will be submitted to a vote of stockholders of both firms.

It is believed that such a merger would bring certain tax advantages under provision of the administration's new technical tax revision legislation.

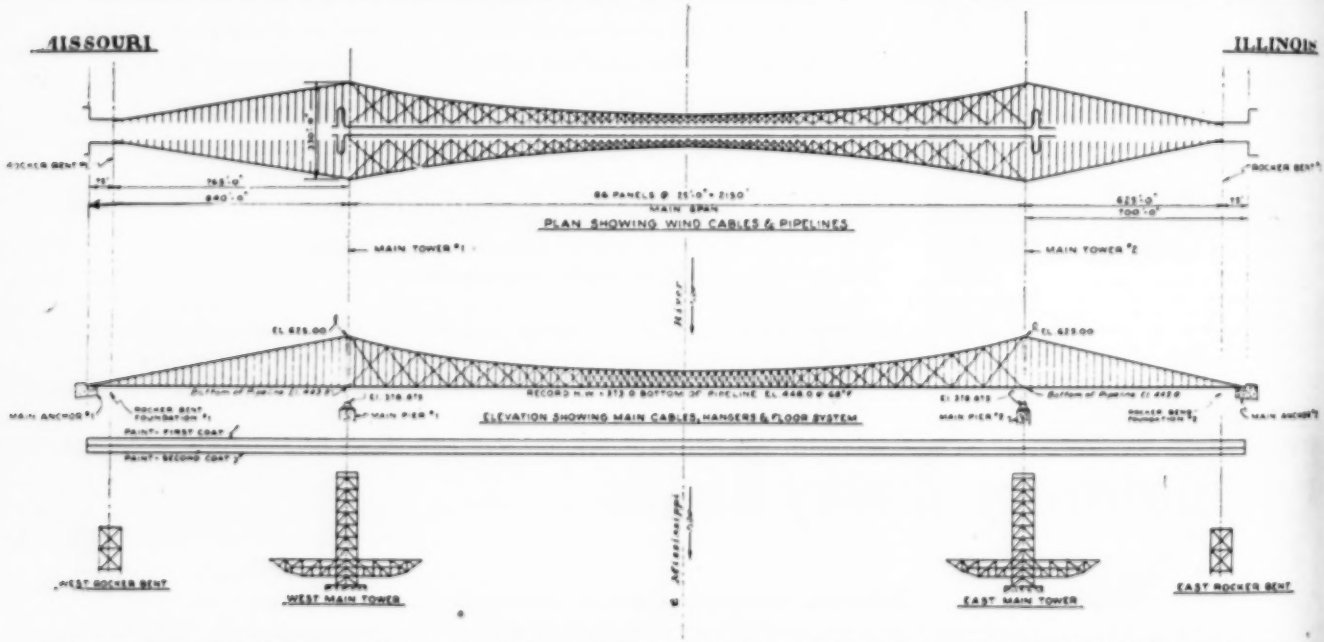
The FPC's decision in the Panhandle Eastern rate case may be another factor—the FPC adopted a new rate-making method designed to bring a better rate of return to gas systems producing and distributing part of their own supplies of gas, reversing its traditional "cost of production" formula for fixing rates.

Pipeline construction planned for North Carolina

Tidewater Gas Co. and its subsidiary, Fayeteville Gas Co., filed an application with the North Carolina State Utilities Commission recently for authority to pipe natural gas to Fayetteville, Fort Bragg, Sanford, Asheboro and Siler City.

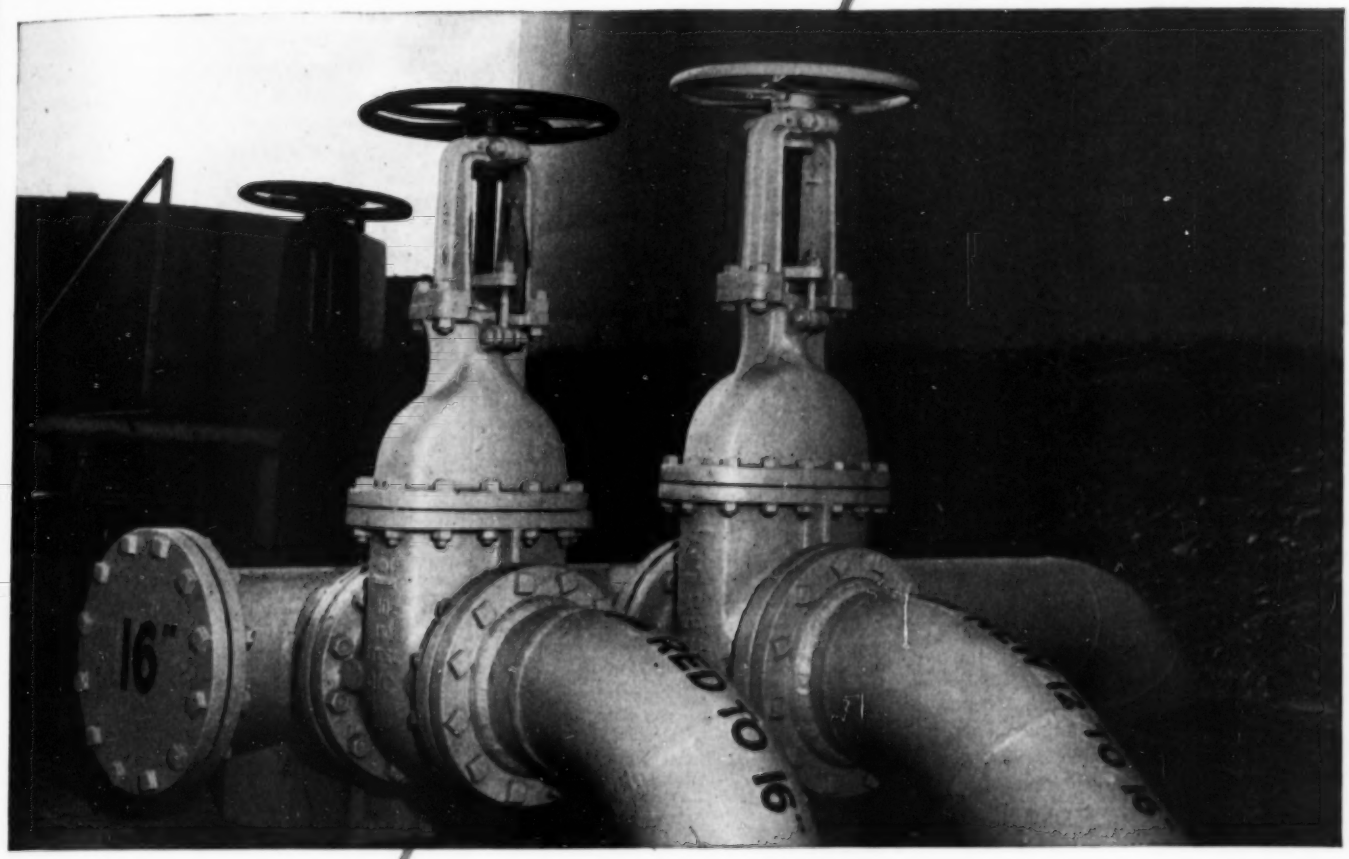
Tidewater Gas recently took over gas systems Carolina Power & Light Co. acquired when it absorbed the old Tide Water Power Co.

The proposed pipeline would connect with the Transcontinental Gas Pipe Line Corp.'s cross-country trunk at a point about 10 miles west of High Point. From High Point, the new line would run via Asheboro,



The new Texas Illinois bridge will have the longest pipeline main span in the world measuring 2150 feet between towers.

Oh, I see



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Northern's construction under way

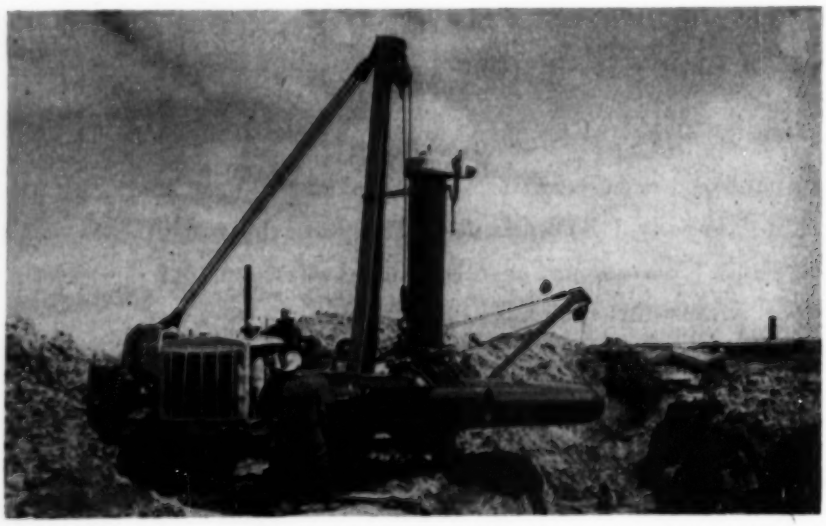
The huge side boom cats lower in part of the 21.01 miles of 30-in. line being laid north of Clifton, Kan.

WITH its $52 million construction program underway, Northern Natural Gas Co., Omaha, expects 1954 to be another banner year construction wise.

An increase in daily capacity of almost a million cubic feet, from 1007 MMcf to 1100 MMcf, involves the installation of 200 miles of mainline loops. Of these 200 miles, almost 190 will be 30-in. pipe. Seven river crossings, including a 5400-ft bridge across the Missouri river, are included. Compressor facilities will be increased by the addition of 24,000 hp at six different stations.

Highlight of the program will be the addition of 71 new communities to Northern's system, bringing the total number of communities served to 307.

Clamshell buckets attached to the cranes dig the ditch on a creek undercrossing



Cat operators prepare to lower the 30-in. block valve into the ditch. The pipe extending to the side will tie in the new fifth line with the four other existing parallel lines.

Sanford and Fort Bragg to Fayetteville. Siler City would be served by a lateral connection.

Clifford B. Ewart, president of Tidewater Gas, said in the application that the Federal Power Commission will be asked to allocate natural gas for the operation if the state utilities commission approves.

Ewart said the line would be built in two stages. The first section would be laid via Asheboro to Sanford and would be scheduled to go into use by the end of 1955. The second section, from Sanford to Fayetteville, would be added, the company said, as soon as the first section is operating successfully and when the Army approves the use of natural gas at Fort Bragg.

The company estimated the line to Asheboro would cost $935,000; the line from Asheboro to Sanford, $1,265,000; the Siler City lateral, $100,000; the Sanford to Fort Bragg line, $690,000, and the Fort Bragg to Fayetteville line, $250,000. It said approximately $1,100,000 more would be spent to provide additional facilities in the towns.

First mass production of 36-in. pipe launched

Heralding a new area in transmission lines, U. S. Steel's Consolidated Western Steel division last month inaugurated the first mass tonnage production of 36-in. pipe for long distance use. The division's first order is for 50 miles of pipe for Transcontinental Gas Pipe Line Corp., Houston. Tom P. Walker, Transco president, and other officials of the company were present as initial production of the pipe was begun at the Orange, Texas, plant.

The 36-in. pipe offers a significant step-up in carrying capacity from the generally used 30-in. pipe. There is only one other gas transmission system using pipe larger than 30-in. and this is 34-in., also produced by the Consolidated Western division. Transcontinental has the pipe earmarked for installation near Tylertown, Miss., and Billingsley, Ala.

Panhandle's cancellation of interruptible rates blocked

The Federal Power Commission has denied the proposed cancellation by Panhandle Eastern Pipe Line Co., Kansas City, Mo., of its interruptible natural gas rate schedules, but prescribed certain modifications in the existing provisions of these schedules.

The commission, in an opinion and order disposing of nine separate cases involving Panhandle, also authorized the company to supply natural gas to two industrial customers but denied a third proposal for service. In addition, the FPC directed Panhandle to supply gas to a customer company for service to still another industrial plant, instead of serving the plant directly as proposed.

Panhandle filed the proposed cancellation

Above unretouched photograph shows the "guts" of the original 2" style 50 single ball race CHIKSAN Swivel Joint after 20 years of rigorous service in the California oil fields. Note the good condition of the wearing surfaces. This joint has been improved through the years to the present modern double ball race joint.

The CHIKSAN Ball Bearing Swivel Joint illustrated above is an unretouched photograph of a veteran of 20 years service on an oil well cementing hose.

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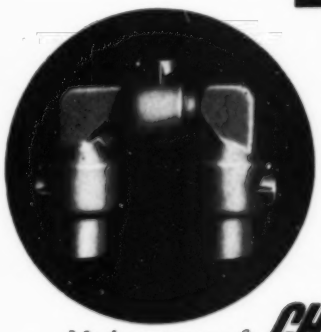

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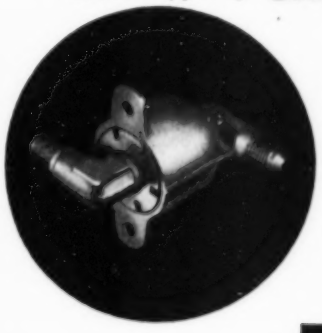

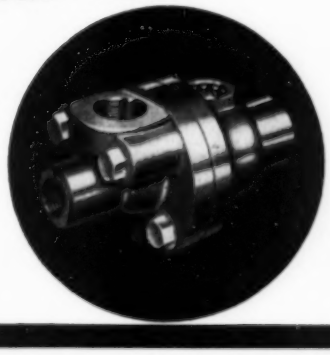

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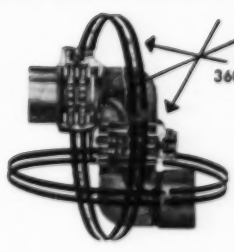

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of its interruptible rate schedules with the FPC last December, claiming among other things that they were "unworkable." Although it denied the cancellation, the commission did modify the schedules. In making the modifications, however, the FPC retained the principle that interruptible gas should be provided first for storage use, with any such gas which is provided thereafter for interruptible sales to be allotted between Panhandle's direct and its resale customers.

The FPC's modification provides a reservation of 20% of excess gas for storage use rather than the complete overriding priority contained in the present schedules. The commission indicated that the allotment of excess gas going to buyers owning or controlling storage facilities should be used only as part of their regular storage operations and that such customers should not be placed in a more favorable position than non-storage customers insofar as interruptible deliveries for other than storage purposes were concerned.

In issuing a certificate to serve DeKalb Agricultural Assn., Tuscola, Ill., the FPC noted that the gas would be transported by Citizens Gas Co., the distributor in Tuscola. The commission added a condition to the certificate providing for the filing of an Illinois Commerce Commission certificate of jurisdiction under Section 1(c) (the Hinshaw Amendment) of the Natural Gas Act.

Chairman Jerome K. Kuykendall, who concurred in the result of the FPC's opinion and order, said that he was "not convinced that the transportation for hire by the distributing companies . . . is or was transportation in interstate commerce."

The FPC also denied authority to Panhandle for service to the Bridgeport Brass Co., at Adrian, Mich., and instead directed Panhandle to supply natural gas to Citizens Gas Fuel Co. for this service. One of the issues in the consolidated proceedings was whether Panhandle should be required to sell natural gas to its customer utilities so that they could render service within their franchise areas which Panhandle is now providing, or which it proposes to render itself. In the other cases, where certificates were issued to Panhandle for direct service, the local distributing utilities did not want gas from Panhandle under its interruptible rate schedules.

In another ruling, the commission interpreted certain penalty charge provisions of Panhandle's firm rate schedules as not permitting the sale of excess gas to customers being served through Panhandle-operated flow control valves. Customers which had been purchasing large volumes of gas under this interpretation were the Ohio Fuel Gas Co. and East Ohio Gas Co.

The FPC also stated that Panhandle could not deliver gas to direct sale customers under priorities of service differing from those contained in its filed tariff.

Seek new hearing in North Dakota pipeline case

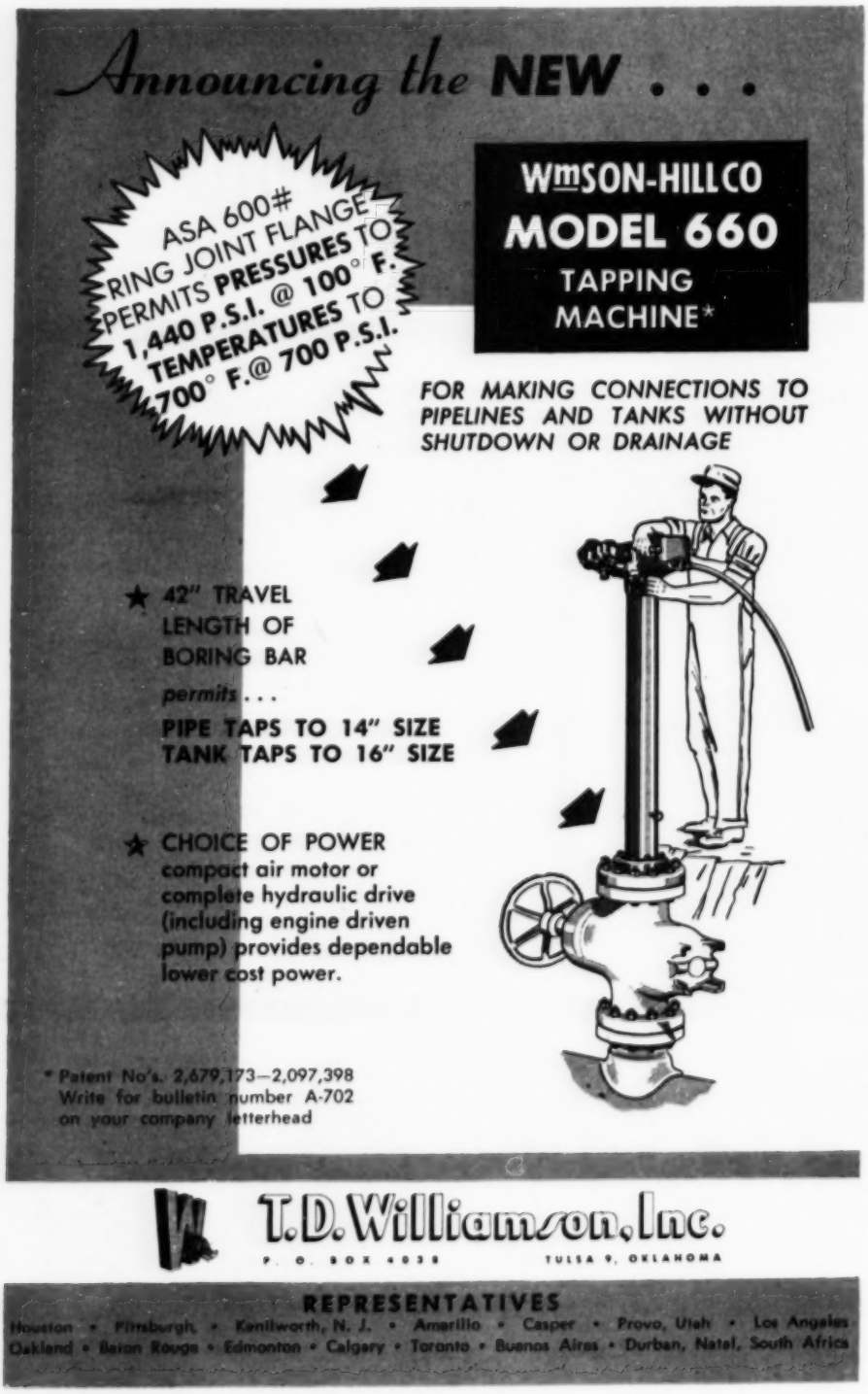
A petition for a rehearing of its pipeline application has been filed by North Dakota Natural Gas Transmission Co., St. Paul, with the North Dakota Public Service Commission. The company's original application for authority to build a 474-mile line from Tioga to Grand Forks and Fargo had been dismissed by the PSC July 20.

As its reasons for asking the rehearing, North Dakota Natural claimed "prejudicial error" on the part of the commission in dismissing the original application, and cited "new matters arising since the hearing and decision."

The company charged the commission had committed prejudicial error in denying its request for modification of a conditional order dated May 24 without giving due notice and an opportunity to be heard.

The utility claimed the commission had committed further error in finding the applicant did not have "any additional evidence," and that "no evidence had been filed to show any of the conditions had been met."

The company said "new matters of substantial importance" had risen "which would materially affect the applicant's proposal and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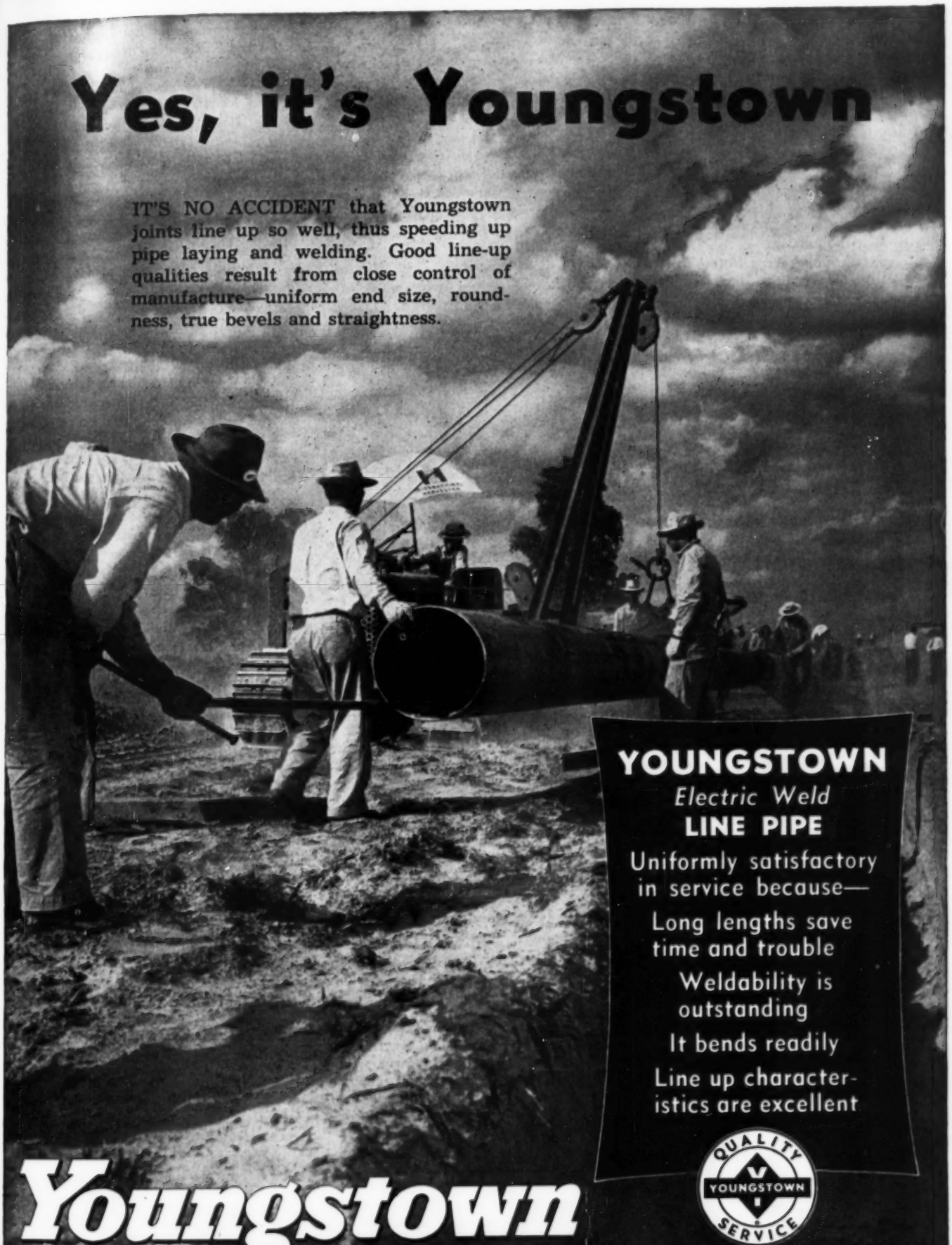

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the commission's decision." These were listed as including:

An extension of time from Amerada Petroleum Corp. for the performance of North Dakota Natural's contract until Aug. 31, 1954.

A firm commitment from Amerada that its officials would appear if a rehearing is granted to offer competent evidence that the applicant will have an adequate supply of gas.

To prove Amerada's intention to drill into the Silurian formation.

To show that Amerada is willing to revise the basis for escalation of prices to be paid for gas by the appliant.

To show it is willing to modify its gas purchase contract.

The rehearing petition further stated that North Dakota Natural has had "extensive negotiations" with Montana-Dakota Utilities Co. for the securing of storage facilities.

The company said that if these facilities are obtained, it would "materially increase its supply of gas for firm (residential) service, not only in communities which it proposes to serve, but also in additional territory."

Meanwhile the hearing on Northern Natural Gas Co.'s request to serve the same market area has been postponed until Oct. 5 by the PSC. Northern Natural told the commission it has not completed negotiations for natural gas for the proposed 24-in. line from Tioga to Fargo, which also would be a segment of its proposed line to bring Alberta gas to Minneapolis-St. Paul.

Expansion under way by Saskatchewan Power Corp.

Hupp Ltd., of Edmonton, has been awarded a contract to build 30 miles of 10-in. line linking the present Brock-Saskatoon pipeline to the Coleville field, according to J. W. Tomlinson, general manager of the Saskatchewan Power Corp. The same firm will construct a field gathering system in the Coleville area that will add 10 to 15 of the Coleville wells to the present system.

The work is being done as a result of the Conservation Board's decision that the power company could withdraw up to 30 MMcf of gas per day from the Coleville area. Construction is expected to start almost immediately, Mr. Tomlinson said, as the bulk of the material is already on hand. The addition is expected to be in full operation early in November.

Saskatchewan Power has also awarded a contract to the Banister Construction Co. to build the natural gas distribution system and pipeline tie-ins for the towns of Sutherland, Vanscoy, Tesier, Harris and Zealandia. Construction crews and materials are already moving into the area and work on the extensions to the present gas system will begin immediately.

Conditional permit granted Trans-Canada

A conditional permit to build its $300 million gas pipeline from Alberta to Montreal has been granted to Trans-Canada Pipe Lines Ltd. that will allow the company to go ahead with financing for the line in order to start construction by next spring.

The conditions set forth by the Board of Transport Commissions in Ottawa are (1) that the company has completed arrangements for the huge financing job and (2) that it has obtained, or will obtain, a federal Canadian permit to export gas to the U. S. The conditions must be met by Dec. 31 and the company has indicated that it expects to be able to meet that deadline.

The board expressed approval of the company's plan to parallel roughly the Canadian Pacific Railroad route across northern Ontario from the lakehead through Nipigon, Schreiber, Marathon, Hawk Junction, Cobalt, Sudbury, and North Bay to Toronto.

The board also supported Trans-Canada's plan for 30-in. pipe, saying that the capacity of the 30-in. line could be built up by adding pumping stations and by looping.

The company's timetable calls for delivery of gas to Winnipeg and the Minneapolis area by late 1955, Toronto by late 1956, and Montreal by 1956 or early 1957. The

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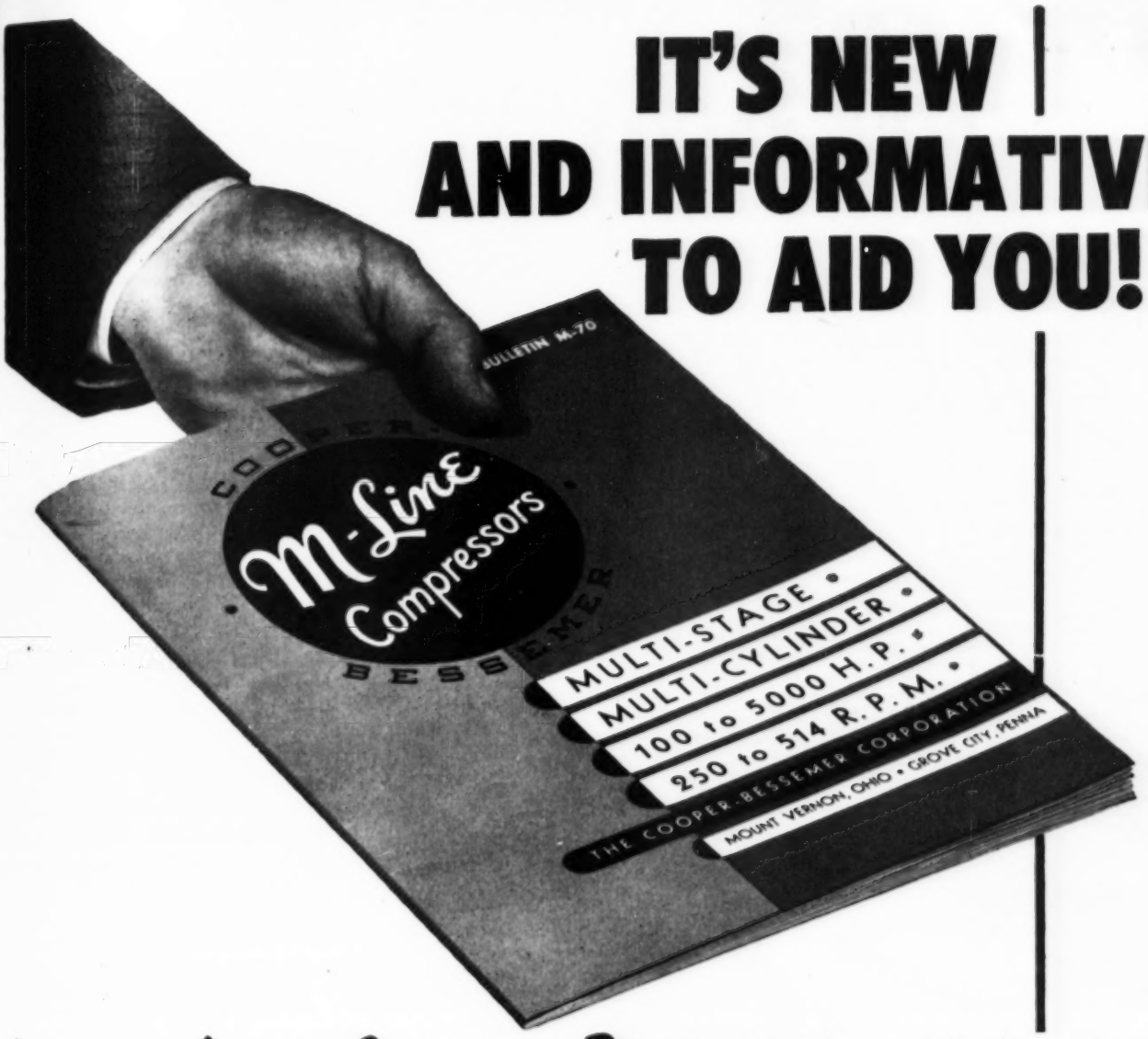

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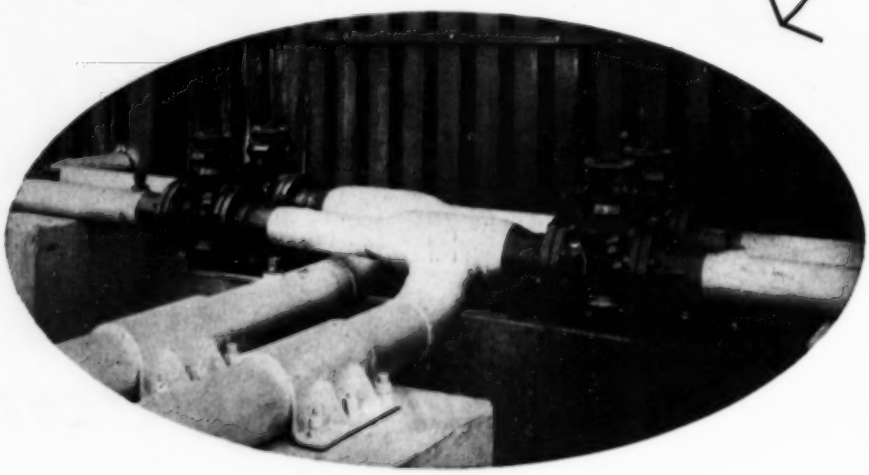

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board's order calls for completion of the whole line by Dec. 31, 1957.

Contracts have been let by Trans-Canada for engineering, management, and procurement for the projected line to a combine of Oklahoma Contracting Co., Canadian Bechtel Ltd., and Mannix Ltd. Trans-Canada has also announced the appointment of C. S. Coates, formerly senior vice president of Tennessee Gas Transmission Co., to the post of executive vice president and general manager. He will have direct charge of construction and operation of the line.

Hope Natural's storage program approved by FPC

The FPC has issued two certificates to Hope Natural Gas Co., Clarksburg, W. Va., one authorizing the company to increase the capacity of a natural gas storage area (Docket G-2312), and the other approving construction of an extension of a pipeline into gas producing fields, all in West Virginia (Docket G-2413).

The capacity of its Kennedy storage pool in Lewis and Harrison Counties, W. Va., would be by 10 billion cu ft of gas, to a total ultimate capacity of 30 billion cu ft. Estimated cost of the project is $1,571,396.

The increase in capacity would be accomplished by constructing a total of about 20 miles of gathering lines, and the reconditioning of 10 storage wells and the redrilling or replugging of 49 storage wells.

The other certificate authorizes Hope to build a 22½-mile extension of an existing line. This same 12-inch line will connect with an existing line in Boone County, W. Va., and extend across Logan County to a point near the Logan-Mingo County line. Total estimated cost is $928,000.

The new facilities will be used to transport 27 MMcf of gas per day from fields in Logan and Mingo counties to Hope's existing pipeline system for further transportation to its markets.

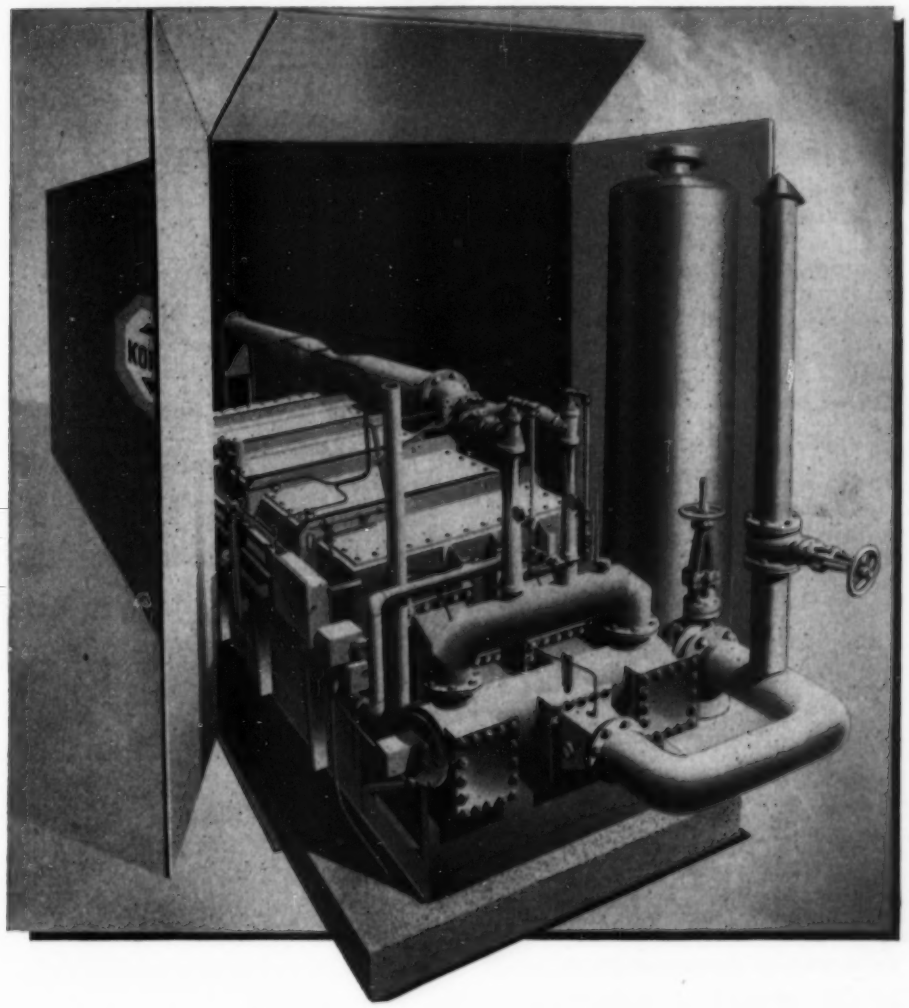
Kansas-Nebraska gets FPC approval of Nebraska line

The FPC has authorized Kansas-Nebraska Natural Gas Co. Inc., of Phillipsburg, Kan., to construct a total of about 221 miles of pipeline and 2700 hp in compressor capacity on its system in Nebraska.

The commission concurrently issued a certificate to North Central Gas Co., Casper, Wyo., authorizing it to transport gas for Kansas-Nebraska from Sidney, Neb., to Northport, Neb.

The facilities to be constructed by Kansas-Nebraska have a total estimated cost of $4,096,890. The new pipe will range in diameter from 6 to 12 inches. Of the proposed additional compressor capacity, 1500 hp will be installed at a new station and the remaining 1200 hp at an existing station.

The new facilities will enable Kansas-Ne



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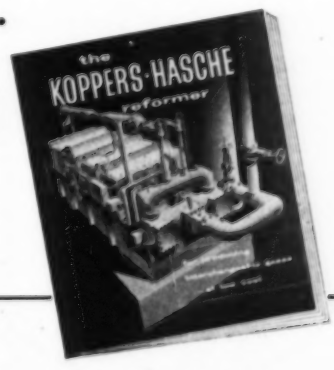

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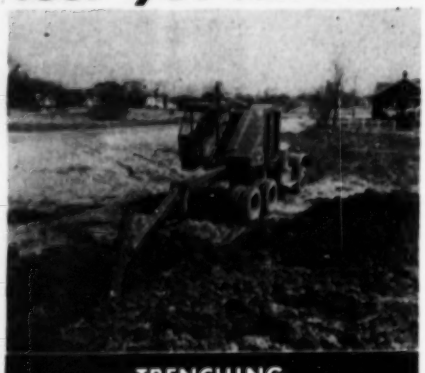

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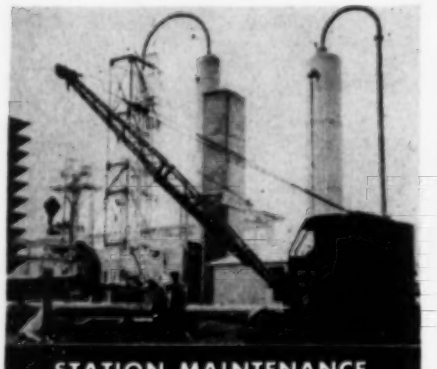
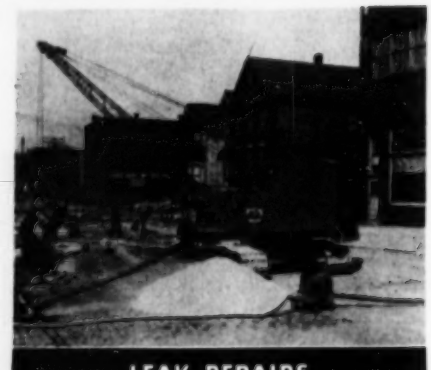


STATION MAINTENANCE



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braska to increase its mainline capacity to transport gas from new and additional sources of supply in western Nebraska and northeastern Colorado to the eastern portion of its system, and also to serve Alliance, Nebraska.

North Central will use existing facilities to transport gas for Kansas-Nebraska. Kansas-Nebraska will use the gas transported by North Central to provide service to Alliance.

Columbia Gas tariff revisions approved

Proposed changes to take effect in the tariff provisions of seven Columbia Gas System subsidiaries to permit industrial firms to buy increased supplies of natural gas from the Columbia system have been approved by the FPC.

Tariff revisions authorized by the commission apply to rate schedules of Manufacturers Light & Heat Co. and Home Gas Co., Pittsburgh; Ohio Fuel Gas Co., Columbus; Atlantic Seaboard Corp., United Fuel Gas Co., Amere Gas Utilities Co., and Central Kentucky Natural Gas Co., all of Charleston, W. Va.

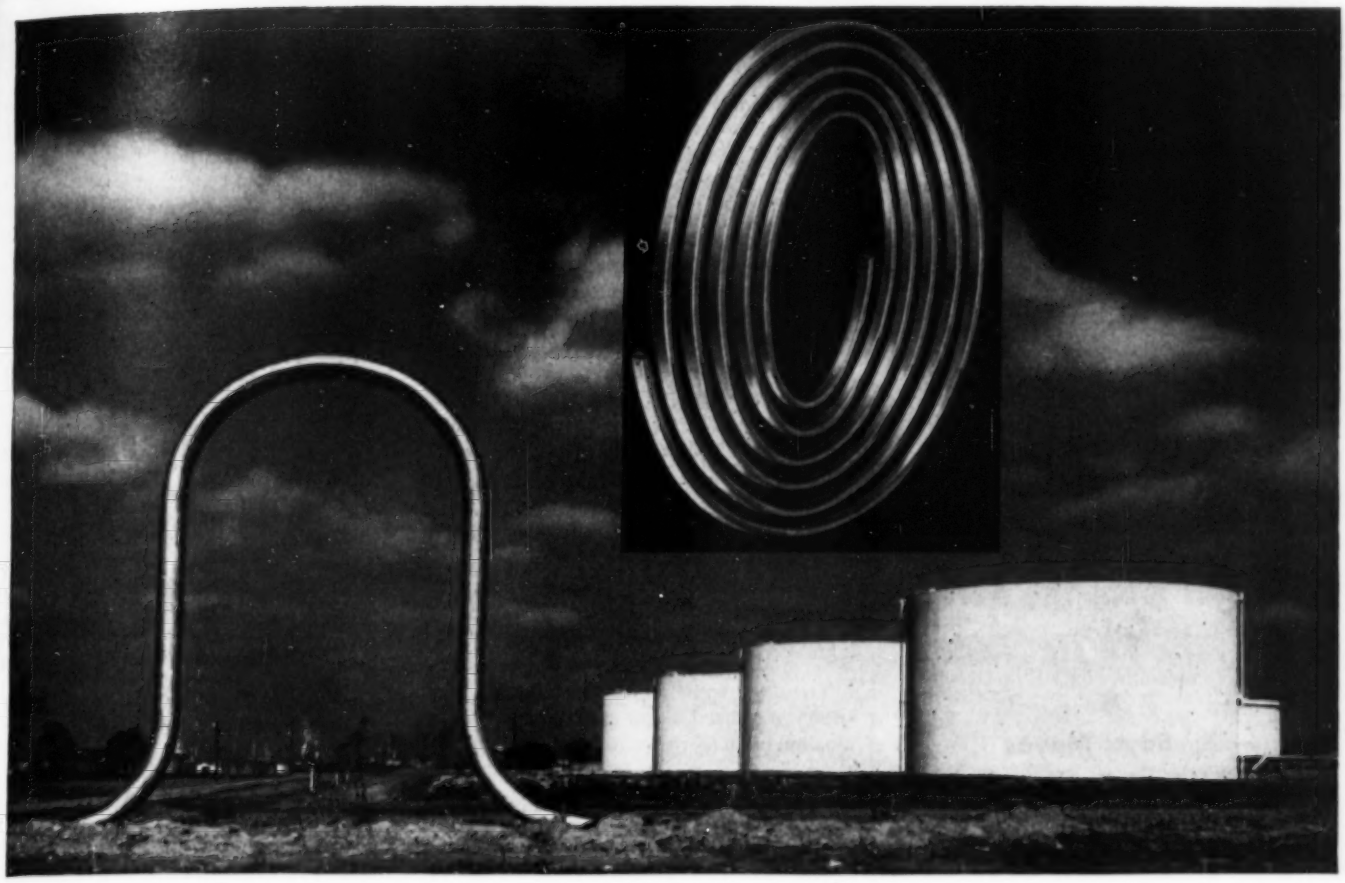
Under the new tariff provisions, the availability clauses in existing rate schedules are changed to permit direct purchasers and resale customers to buy up to 2 MMcf per day of natural gas for ultimate consumption as boiler fuel. Former limitations had placed a 500 Mcf per day ceiling on such sales.

TET asks FPC okay of Little Inch conversion

By filling an application with the Federal Power Commission, Texas Eastern Transmission Corp., already one of the nation's largest transporters of gas, formally launched a long studied plan, which if successful, will make it one of the largest common carriers of petroleum products as well. The plan contemplates the reconversion to petroleum products transportation of that portion of the company's Little Inch gas pipeline extending approximately 1168 miles from a point near Baytown, Texas, to Moundsville, W. Va. The 20-in. diameter line now transports about 200 MMcf of natural gas per day; on conversion it would be capable of transporting a maximum of 235,000 bbls of petroleum products per day.

In the application to the FPC seeking permission to remove this portion of the Little Inch from gas service, Texas Eastern also seeks authorization to construct substitute natural gas facilities estimated to cost $71,814,000 in order to maintain the system's present delivery capacity of more than 1.2 billion cu ft per day. These substitute facilities would include approximately 382 miles of new 24-in. pipeline extending from Beaumont, Texas, through the prolific natural gas producing area of southern Louisi-

DOW



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Given reasonable conditions, Galvo-Line can be installed at rates upward of 3,000 feet per hour—the equivalent of installing 35 Galvo-Paks® in the same time. Connection-making costs are also reduced—one connection every 500-1000 feet will usually suffice. Uniform distribution and efficient utilization of current contributes greatly to Galvo-Line's economy and dependability in galvanic pipeline protection.

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HOT DOPE

Straight from the Kettle on PIPE PROTECTION

★

By Boyd Mayes

● Ever think about how specialized everything's gettin' to be? One doctor helps get the baby born, and right there he quits. You gotta get another specialist to keep the kid going. One mechanic works on your automobile brakes and sends you around the corner to get the radiator leak mended. Try gettin' your house fixed and the brick man won't touch the boards. If it keeps up the present trend you may some day have to have a separate painter for each color. Specialization is really not new. In the frontier days of West Texas the cow man was always takin' pot-shots at the neighbor who raised sheep. We got our idea of specialization as a kid back in the Piney Woods when we found that a coon dog that would mess with a skunk wasn't worth shootin'. There's a special way to split a stick, too, if you want to put a possum's tail in the crack. Specialization's a good thing, and we're all for it. We live by it. We specialize in the pipe line business, and we go further than that. We're almost in the same category as the foot doctor who won't work on nothin' but left big toes. We don't make pipe, don't bend it, don't dig ditches for it, don't string it nor lay it. We don't make pipe winches, booms, cradles, saddles, Holiday detectors or any other pipe line accessories. We just protect pipe for long life, trouble-free service by cleaning, priming, coating and wrapping it. At that, we admit we're good. We've been doing this specialized job for more than a quarter century. The woods are full of our satisfied customers, but we could still use some more.

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ana to connect with the company's 30-in. pipeline at Kosciusko, Miss.

According to George T. Naff, president, the project as planned will: (1) achieve greater flexibility for the natural gas system while at the same time maintaining the present volume of natural gas deliveries; (2) decrease slightly the cost of making natural gas deliveries to customers; and (3) result in a revamped natural gas system susceptible of additional increases in capacity later on without any material increase in the average transportation cost.

According to the application the company "proposes to file rates for transportation that will yield a reasonable return to it and provide service in marketing centers at a cost to shippers that will be competitive with and lower than the transportation rates charged by existing forms of transportation, thereby providing reduced ultimate cost to consumers."

According to the announcement, the gross book value of the facilities contemplated for transfer to the products pipeline system is approximately $64.4 million and an initial expenditure of about $13 million would be made to place it in operation.

The application for new natural gas facilities in addition to the 382 miles of 24-in. pipeline provides for construction and operation of approximately 99½ miles of lesser diameter pipeline, 10 new compressor stations totaling 86,900 hp, and additions to existing compressor stations amounting to 36,020 hp.

Mr. Naff stated that in connection with the plans for a product pipeline system Texas Eastern has recently secured the services of J. B. Saunders as vice president.

Houston Texas Oil plans service to Florida

Houston (Texas) Oil & Gas Co. has modified its original proposal made 18 months ago to move gas from Louisiana to New York, which was later revised to go via a Florida-Georgia route. The company's latest plan, which it is said will be put before the FPC soon, is to build a 1000-mile line into Florida and Georgia.

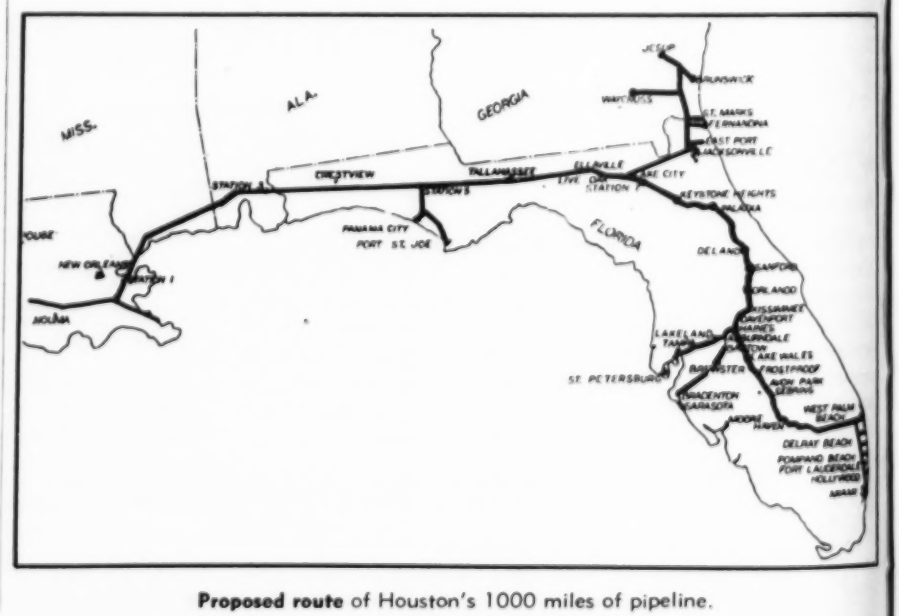
The new plan is to lay 300 miles of 34-in. and 300 miles of 30-in. mainline, in addition to about 400 miles of 16- and 20-in. laterals. The system would originate in the Louisiana Delta fields. Lateral lines from Houma, La., and near the mouth of the Mississippi would converge near Point a la Hache, La. From the junction, the line would go north of Mobile, Ala., almost due east past Tallahasse, Fla., to Lake City, Fla., with branches going north to Georgia and south into Florida from there.

J. O. Mack, president of the company, said the huge system would have an initial daily capacity of 500 MMcf with "plenty of reserves lined up." He said that his company is not competing with any other natural gas pipeline in Florida inasmuch as Pensacola is the only major Florida city now receiving natural gas. Plans for the new system do not alter the company's proposal to lay a 30-in. line from east Texas fields to Chicago and Duluth, Minn.

Service approved for Florida and Georgia area

Presiding Examiner Emery J. Woodall has filed a decision authorizing South Georgia Natural Gas Co., Birmingham, to construct and operate a 368.3-mile natural gas transmission system to serve new market areas in Georgia and Florida (Docket G-1915).

The South Georgia transmission line authorized will begin at a point of connection with the Southern Natural Gas Co. system in Lee county, Ala., and will extend southeast to a point near Albany, Ga. From Albany, a branch pipeline will run via Valdosta, Ga., to Ellaville, Fla. A second sub-



Proposed route of Houston's 1000 miles of pipeline.

sidiary line will be built at a point near Moultrie, Ga., to extend to a terminus located near the Georgia-Florida border. Pipe used in the mainline will be 12¾ in. in diameter and diameter of the branch pipelines will vary from 10¾ in. to 6⅝ in.

Estimated cost of the project is $8,969,429. Through its new system, South Georgia will sell and deliver natural gas for resale to 14 Georgia and Florida communities. Laterals will extend from the company's main transmission lines to Albany, Americus, Bainbridge, Cairo, Camilla, Dawson, Moultrie, Pelham, Richland, Thomsaville, Ga., and to the Atlanta Gas Light Co. for resale in Valdosta, Ga.; and to Havana, Quincy and Tallahassee, Fla. South Georgia also will make direct interruptible gas sales to five industrial customers.

Peak day deliveries for the first three years of operation are estimated at 15,132 Mcf, 18,026 Mcf and 20,445 Mcf, respectively.

Presiding Examiner Woodall conditioned the authorization to order South Georgia to extend natural gas service in the initial stage of the project to the city of Cordele, Ga.

FPC gives go-ahead to Montana-Dakota on line

Montana-Dakota Utilities Co., Minneapolis, has received temporary authorization from the FPC for the construction and operation of new natural gas transmission facilities in Montana, South Dakota, and Wyoming.

One of the temporary certificates (Docket G-2382) authorizes the company to build a total of about 49 miles of pipeline and an additional 440 hp in compressor capacity on its system in Montana and South Dakota, designed to enable it to meet increasing loads of present markets.

The other temporary authorization (Docket G-2414) is for the construction of about 4.2 miles of pipeline in Big Horn County, Wyo., a new metering station in Carbon County, Mont., and the lease and operation of a 2640-hp compressor station to be constructed by Montana-Wyoming Gas Pipe Line Co. in Big Horn County, Mont.

Northern seeks Iowa okay on underground storage

Preliminary plans have been completed for a natural gas underground storage project near Redfield in Dallas county, Iowa. Northern Natural Gas Co., Omaha, has filed with the Iowa Commerce Commission for permission to go ahead with its plan to store about 50 billion cu ft of gas.

In addition to authorization for the reservoir, Northern is asking permission to make test injections of gas into holes drilled below the surface. The Iowa commission said the area proposed for the reservoir covers about 8440 acres. Of the 50 billion cu ft, 25 would be cushion gas.

Company officials say that if all factors turn out favorably in the planned injection tests, there will be a storage field that would supply the equivalent of 200 MMcf per day of pipeline capacity.

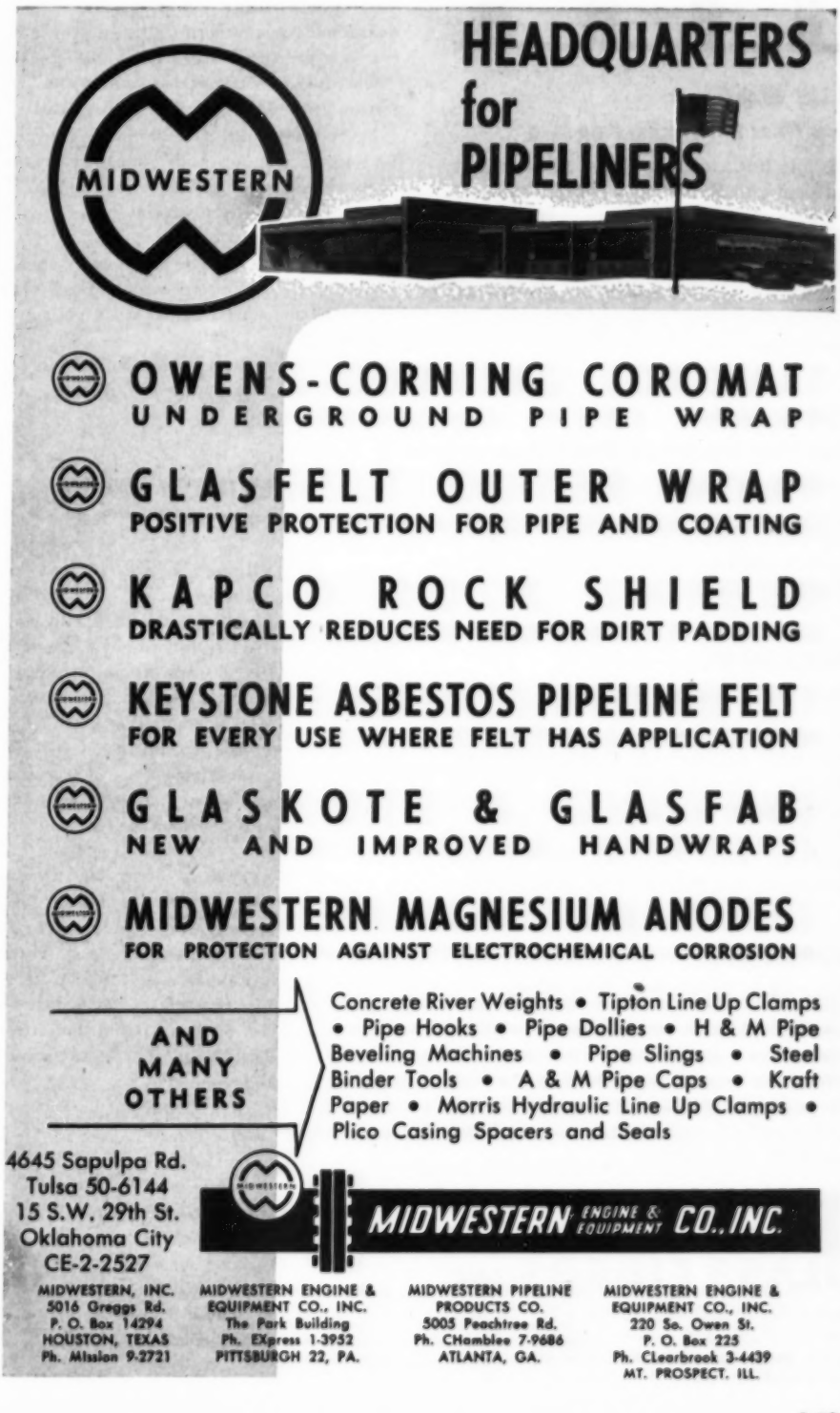
Northern would serve 20 South Dakota towns

Northern Natural Gas Co., Omaha, has filed an application (Docket G-2465) with the Federal Power Commission requesting authority to construct a total of about 330 miles of pipeline to supply natural gas service to 20 communities in South Dakota.

Northern proposes to extend its mainline facilities from a point near Sioux Falls, S. D., about 165 miles to Aberdeen, S. D. The company also would build about 164½ miles of branch lines, and town border stations to make gas available to the 20 towns. Total estimated cost of the project is $6,661,100.

The mainline extension would consist of 94.1 miles of 12¾-in. pipe and 70.9 miles of 10¾-in. pipe. The 164½ miles of branch lines would vary in size from 2 to 8 in.

The 20 communities which Northern proposes to serve initially are Aberdeen, Hartford, Montrose, Salem, Spencer, Alexandria, Mitchell, Madison, Ramona, Arling-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ton, Volga, Brookings, Lake Preston, De Smet, Huron, Willow Lake, Vienna, Watertown, Raymond and Turton. In addition, the company proposes to utilize the mainline extension in the future to supply Colton, Dell Rapids, Flandreau, Farmer, Oldham, Hazel, Clark, and Stratford.

Of the 20 communities proposed to be served initially, Northwestern Public Service Co. would distribute gas in 17, and Central Electric and Gas Co. would distribute gas in the remaining three.

Biggest Inch capacity upped to 705 MMcf daily

Daily capacity of the Biggest Inch pipeline, which brings natural gas from west Texas fields to southern California consumers, was increased 150 MMcf last month when three new compressors went into operation at the Blythe compressor station.

Seventy-three miles of 30-in. looped pipeline along the 215-mile stretch from the Colorado river to Los Angeles were added last fall to take care of the increased capacity.

Addition of the three Clark compressors —each rated at 1760 hp—steps up daily capacity of the Texas-California pipeline to 705 MMcf.

Both the line and the Blythe station are owned jointly by Southern California and Southern Counties Gas Co.s.

Pipeline Notes

Operating revenues of natural gas pipeline companies totaled $123,055,442 in May and $1,509,357,038 for the 12-month period then ended, representing increases of 12.7% and 19.0% over revenues received in the like periods a year ago, according to FPC reports. Gas sales to other gas utilities for resale for the month were 374,687 MMcf, 8.1% over May 1953. Sales to ultimate consumers during the month were 10,878 MMcf, up 4.8% over last May.

Cooper-Bessemer Corp., Mt. Vernon, Ohio, has announced that Southwest Industries Inc., Houston, will sell packaged GMXA compressors in the states of Texas, Louisiana, Oklahoma, Arkansas, and New Mexico. Cooper-Bessemer will furnish the compressors to Southwest and Southwest will, in turn, build the skid bases and handle the erection and assembly of all piping and necessary auxiliary equipment to complete the packaged unit.

Five more companies have been exempted from the provisions of the Natural Gas Act under the Hinshaw Amendment. They are: Kings County Lighting Co., Brooklyn; San Diego (Calif.) Gas & Electric Co.; Southern California and Southern Counties Gas Co.s, Los Angeles; and Frederick (Md.) Gas Co. Inc.

Progress Reports

NEW CONSTRUCTION PLANNED

HOUSTON TEXAS OIL & GAS CO. A 1000-mile 34-in. line from Texas to Florida to serve communities in Georgia and Florida.

NORTHERN NATURAL GAS CO., Omaha. Docket G-2465 (Aberdeen, S. D., extension) for approximately 94.1-mile, 12¾-in. line and 70.9-mile, 10.3-in. line; 164.5 miles of branch line ranging from 2- to 8-in. to serve 28 towns in South Dakota.

TEXAS EASTERN TRANSMISSION CORP., Shreveport. Docket G-2503 for 481 miles of line, 86,900 hp in new compressor stations, and 36,020 hp additions at existing stations—all to be located in Texas, Louisiana, Mississippi, Tennessee, Kentucky, Ohio, Pennsylvania, and Alabama. Project would include a 382-mile line from Beaumont, Texas, to Kosciusko, Miss.

CURRENT CONSTRUCTION

HOPE NATURAL GAS CO., Clarksburg, W. Va. Docket G-2412 for 19.9 miles, 6- and 16-in. gathering lines to increase capacity of Kennedy storage pool in Lewis and Harrison counties, W. Va. Pipe Line Construction & Drilling Co. at work.

HOPE NATURAL GAS CO., Clarksburg, W. Va. Docket G-2413 for a 22½-mile, 12-in. extension to existing line in Boone county, W. Va., to extend across Logan county to connect with producing wells. Pipe Line Construction & Drilling Co. at work.

GULF INTERSTATE GAS CO., Houston. Docket G-2058 to construct 850 miles of 30-in. line from Rayne, La., to Boyd county, Ky., 309 miles lateral lines and five 8000-hp compressor stations in four states. Mainline contracts let to H. C. Price and Houston Contracting Co. Lateral line contracts let to Anderson Bros., Associated Pipe Line Contractors and William Bros. Line to be in service Nov. 1, 1954. Pipeline complete; work on compressor stations nearing completion.

KANSAS-NEBRASKA NATURAL GAS CO., Phillipsburg, Kan. To build 36 miles of lines to serve communities in two northeast Colorado communities. Sterling Construction Co. at work.

MISSOURI PUBLIC SERVICE CO., Warrensburg. Mid-States Construction Co. was scheduled to begin work July 15 on 25 miles of 10-in. line from Warrensburg to Clinton.

OHIO FUEL GAS CO., Columbus. Docket G-2288. Contracts let: 7½-mile, 16-in. line, Berlin Heights to Norwalk; 13.3-mile, 16-in. N. Baltimore to Bowling Green. Construction under way: 6.6-mile, 16-in. line to Kenton. Completed: 11-mile, 20-in. and 10½-mile, 16-in., New Riegel to N. Baltimore.

OHIO FUEL GAS CO., Columbus. Docket G-2408 for 24.5-mile, 20-in. line in Richland and Crawford counties, Ohio, to enable it to transport additional gas from underground storage.

PACIFIC GAS & ELECTRIC CO., San Francisco. Docket G-2102 to build about 200 miles of 34-in. mainline loops and add 2500-hp compressor capacity to company's 500-mile Topock-Milpitas line. Pipeline work under contract to Engineers Ltd. Pipeline Co. Compressor to Bechtel Corp. Project to be completed in 1954. One hundred and seventy-three miles 34-in. loop now in operation. Associated construction of 7.2-mile, 30- and 34-in. and 1.9-mile, 22- and 24-in. between Milpitas and Irvington proposed for 1954 construction.

SOUTHERN NATURAL GAS CO., Birmingham. Docket G-1907. About 250 miles various size line and 4400 hp compression remaining for construction in 1954 and 1955. Construction on 100 miles of 18-in. underway.

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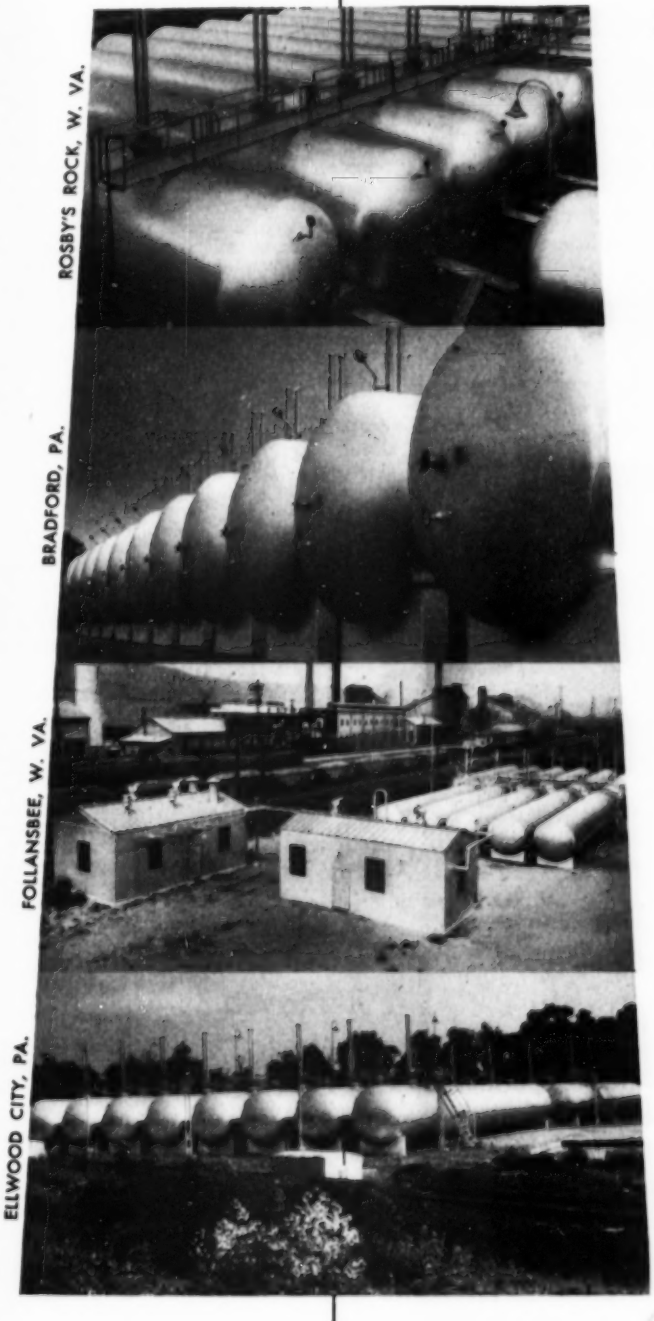

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TENNESSEE GAS TRANSMISSION CO., Houston. Docket G-1969 for permission to carry gas for Iroquois Gas Corp., Buffalo, to export gas to Niagara Gas Transmission Ltd., Toronto, and to construct 904 miles of line—571 mile, 30-in. from Kinder, La. to Portland, Tenn.; 63 miles of 26-in. loop in Ohio; 45 mile, 20-in. line from Buffalo to U. S.-Canadian border; 58 mile, 20-in. line from Gulf Coast to Kinder station; and 167 miles of laterals in Texas; 17,520 hp additional at existing stations; 6600 hp in one new station. Contracts let to Morrison Constructors Inc., Anderson Brothers Corp., Houston Contracting Co., Oklahoma Pipe Line Constructions, Western Pipe Line Constructors Inc., and Panama-Williams Co. for Kinder, La. to Portland, Tenn. line; H. C. Price Co. for the Ohio loop lines; and Bechtel Corp. for spur line from TGT system to Canadian border. All spreads working on the Kinder-Portland line and 300 miles have been lowered in. Work has begun on Ohio loop line and spur line.

TEXAS GAS TRANSMISSION CORP., Owensboro, Ky. Docket G-2361 to construct 24-mile, 16-in. line in south Louisiana; add 2000-hp compressor unit at Bastrop, La.; and build purchase meter station in south Louisiana. Pipeline contract let to Houston Contracting Co. Work to start not later than Nov. 1. Longview Equipment Co. has started work on compressor.

TEXAS EASTERN PENN-JERSEY CORP., Shreveport. Docket G-2341 to construct 265 miles of 24-in. line from Oakford storage field (Pa.) to Texas Eastern Transmission Co.'s Lambertville, N. J., compressor station; a 3300-hp compressor station near storage field. Parkhill Truck Co. hauling, stringing, and unloading approximately 96-miles 24-in. pipe from Mt. Union, Pa. to Duncannon, Pa., and Blairsville, Huntingdon, Pa. Williams-Austin Co. and H. C. Price Co. are contractors. Work on all spreads, river crossings, and the compressor station under way and on schedule. Scheduled for operation by Nov. 15.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston. Docket G-2362 for 19-mile, 12-in. line and sale of existing 14-mile, 6-in. line in Vermilion parish, La. Associated Pipe Line Contractors at work. To be completed Oct. 1.

TRANSCONTINENTAL GAS PIPE LINE CORP., Houston. Docket G-2368 for 57 miles of line parallel to existing system in Louisiana, Mississippi, and Alabama. Contracts awarded to Associated Pipe Line Contractors Inc. Work commenced July 12; to be completed Nov. 1, 1954.

TRUNKLINE GAS CO., Houston. Docket G-2402 for two 24-in. Mississippi river crossings in the Greenville, Miss. area. Also 26-in. interconnecting lines to link new crossing with company's system. Missouri Valley Dredging Co. at work on job. Completion expected Oct. 15.

UNITED FUEL GAS CO. and CENTRAL KENTUCKY NATURAL GAS CO., Charleston, W. Va. Docket G-2285 for construction of a 4400-hp compressor station at its storage pool X-59 in Jackson county, W. Va. Also 59 miles of line and 6000-hp compressor station. Contract let to H. C. Price Co. for 57 miles of 30-in. More than 31 miles completed.

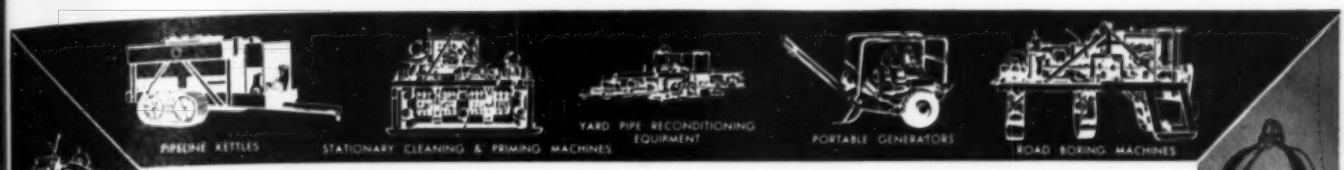
APPROVED

COLORADO-WESTERN PIPELINE CO., Denver. For 328-mile line from southwest Colorado to serve Denver, Pueblo, and Colorado Springs; 220 miles of 18-in. and 108 miles of 16.

KANSAS-NEBRASKA NATURAL GAS CO., Phillipsburg, Kan. Docket G-2392 for 223 miles of 6- to 12-in. line, a new 1500-hp compressor station, and 1200 hp additional at existing station to provide additional capacity on its system in central and northeastern Nebraska.

MONTANA-DAKOTA UTILITIES CO., Minneapolis. Docket G-2397 for 56-mile line in Hettinger and Stark counties, N. D., to supply Regent, Mott, New England, and Lefor, N. D.

SOUTH GEORGIA NATURAL GAS CO., Birmingham, Ala. Docket G-1915 for 368-mile, 12¾-in. line beginning at connection with Southern Natural line in Lee county, Ala., extending southeast to serve new communities in Georgia and Florida.



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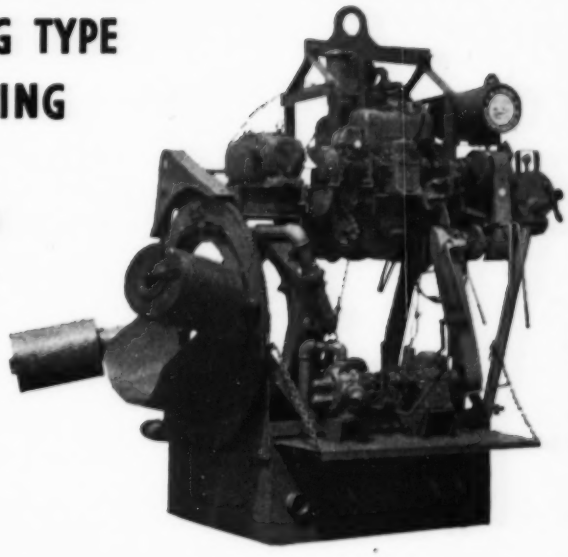

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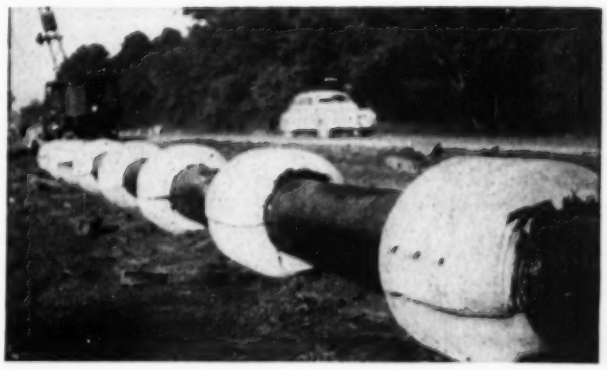

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Pipeline People

Cooper-Bessemer Corp., Mt. Vernon, Ohio, has announced the formation of three primary engineering divisions, each headed by its own chief engineer. Heading the development division is W. R. CROOKS. The product division is headed by DENNIS L. GALLOGLY, and T. O. KUIVINEN is chief engineer of the technical division. The new engineering organization plan will be headed by R. L. BOYER, vice president and chief engineer, and the programs of the three divisions will be coordinated by E. FREEDICK, executive engineer.

Plastic Engineering & Sales Corp., Fort Worth, Texas, has appointed GEORGE V. MORGAN and NORMAN H. OHLSEN as its corrosion mitigation sales force. Mr. Morgan's territory will be the lower Gulf coast of Texas, and Mr. Ohlsen's will be the state of Oklahoma.

E. T. LARSEN and DR. W. C. RUECKEL have been named vice presidents of the Henry J. Kaiser Co., parent company of the Kaiser group of industries.

Several advancements have been announced by United Gas Corp., Shreveport. D. D. DILLINGHAM becomes superintendent of operations of United Gas Pipe Line Co., replacing D. R. PFLUG, who has resigned. PAUL WILLIAMS is chief engineer of the pipeline company and Union Producing Co., succeeding V. E. HAMILTON Jr. who has resigned. J. D. DAVIS succeeds Mr. Dillingham as superintendent of the company's western pipeline division, and R. M. HEARIN advances to Jackson, Miss., district manager of both companies, succeeding Mr. Davis.

O. E. MCCULLOUGH JR. has been appointed to the new division sales office of Pittsburgh Coke & Chemical Co. in Dallas. Mr. McCullough will be in charge of coal tar coating sales.

WALTER H. DAVIDSON, general superintendent of Transcontinental Gas Pipe Line Corp., Houston, has been elected a vice president of the company.

WILLIAM F. KNODE, who was the first chairman of the Alberta Petroleum and Natural Gas Conservation Board, has been appointed general manager of Alberta Gas Trunkline Co. Ltd., a newly incorporated company that will gather and transmit gas within Alberta for local consumption and export.

ROBERT E. HERMANN, supervisor of billing for Texas Gas Transmission Corp., Owensboro, Ky., has been appointed manager of market statistics, a newly created position in the sales and customer relations department.